AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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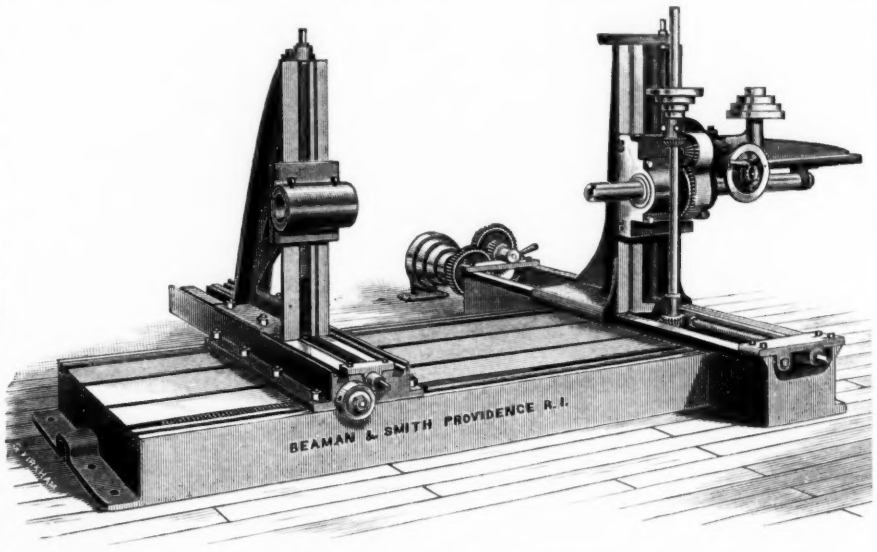
Drilling and Boring Machine.

The accompanying illustration is of a new horizontal spindle drilling and boring machine recently brought out by Beaman & Smith, of Providence, R. I., the controlling idea of its design being that it is not only easier and more convenient to move a light spindle to various parts of a piece of work than to move the heavier work about, but more accurate work is apt to result where a number of holes are to be drilled or bored parallel to each other.

In this machine the work is clamped to the bed-plate, which rests upon a suitable foundation, and can support any weight which it may be desirable to place upon it. One of the cross-slides is fixed at the end of this bed-plate, while the other is movable, the maximum space between them for work being 70 inches. The platen is 8 inches high from the floor, 40 inches wide and 84 inches long. The uprights have a travel on the cross-slides of 40 inches, and the spindle can be moved vertically 30 inches, being in its highest position 40 inches above the platen. The spindle is fed automatically 24 inches, and is driven by a 2½-inch belt running on a five-stepped cone pulley, geared 3 to 1 direct, and 24 to 1 with back gears, giving ten changes of speed. The spindle sleeve is supported in taper boxes at each end, which can be taken up to compensate for wear, and there are four steel rules attached to the various slides, by which the spindle and the outboard bearing can be accurately moved any desired distance and kept in line.

It has been the aim to produce a machine capable of a large range of work without undue heaviness, and without sacrifice of rigidity or power.

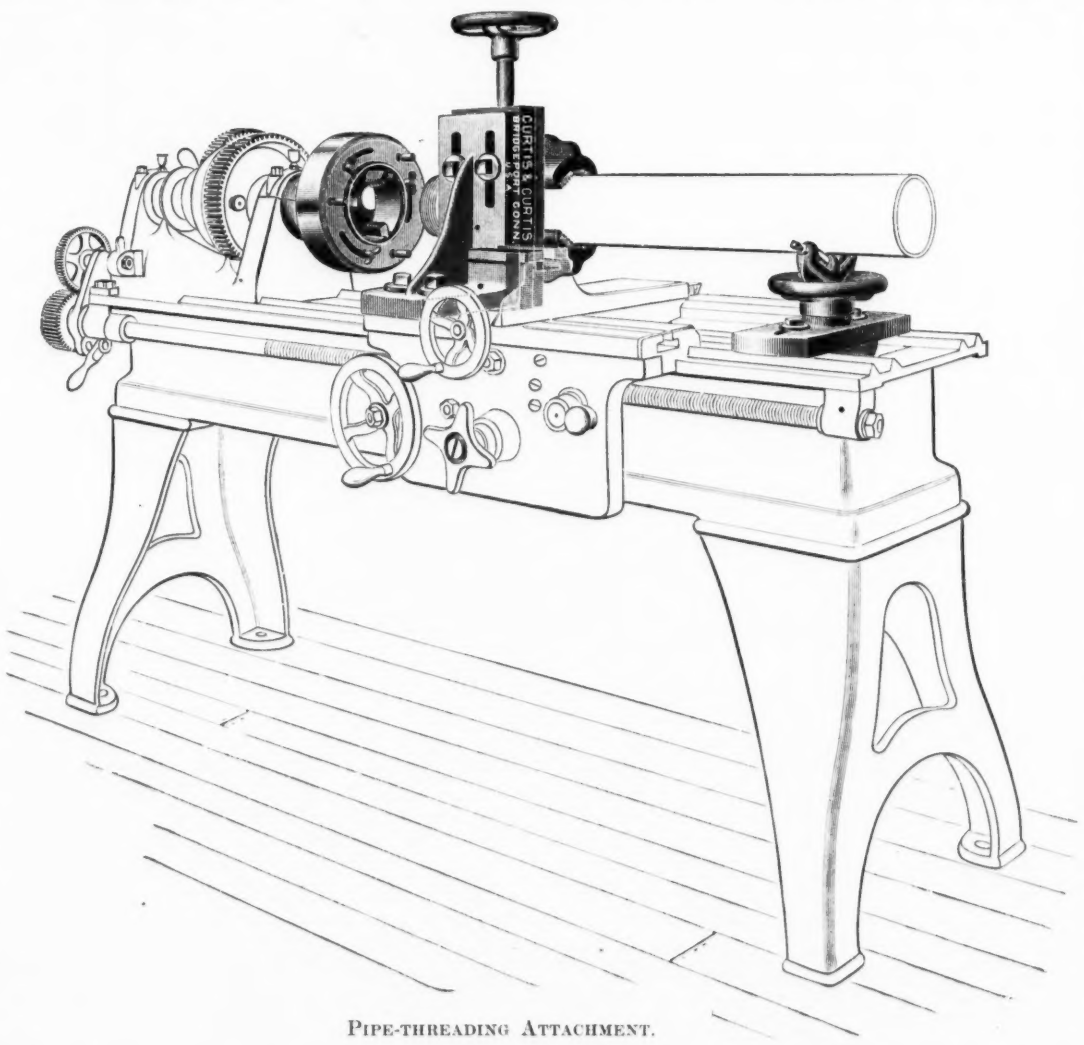


DRILLING AND BORING MACHINE.

Pipe-threading Attachment for Lathes.

All who have occasion to thread wrought-iron pipe know the difficulty with which it is attended when not done on a regular pipe-threading machine. In most machine shops it is done on an ordinary lathe with the usual chasing tool. This is not only very inconvenient on account of the length of the pipe, but it is very difficult to make a thread that will give a good joint, on account of the thread being tapered, as well as requiring much unnecessary time and labor.

To meet this want of those whose work does not warrant the purchasing of a regular power pipe-threading machine, Curtis & Curtis, of Bridgeport, Conn., have just brought out and placed on the market a new lathe attachment, which can be used with any lathe, within certain limits of size, and with which a lathe can be turned into a power pipe-threading machine in a few minutes, with which pipe of any length can be threaded very rapidly and correctly. This attachment consists of a die-carrying head, attached to the spindle like a chuck, an adjustable, self-centering vise, attached to the carriage, and an adjustable pipe rest, attached to the bed of the lathe, to support long lengths of pipe, as shown by the shaded portions of the accompanying illustration. The pipe is held securely by the vise on the carriage and fed to the revolving dies by moving the carriage. This can be done automatically by setting the lead screw of the lathe to cut the number of threads corresponding to standard of pipe to be cut. When the thread is cut to the length required, the dies can be opened by turning the face-plate, and the pipe taken out without running back. All the dies are made adjustable to any variation of the fittings, and they adjust from one size of pipe to another, so that each set of dies threads several sizes of pipe without changing. To fit this attachment to any make or size of lathe no machine work is necessary except on the flange connecting the die head to the spindle. For this flange a rough casting is sent, and it is necessary for the user to cut the thread to fit his particular make of lathe. The attachment shown in cut has a range from one to four inches right-hand inclusive, and is attachable to lathes of any make or size from 14 to 24 inches swing. Other sizes will be made if desired.



PIPE-THREADING ATTACHMENT.

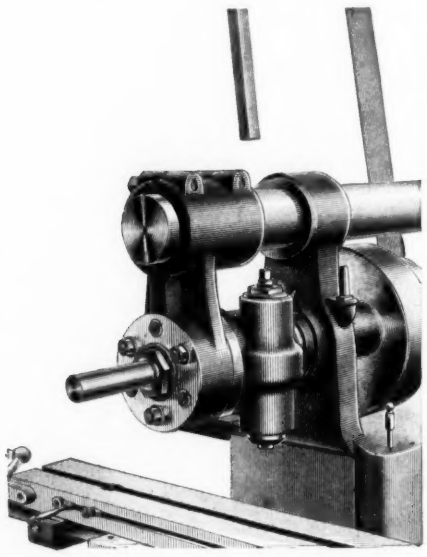
A type of drill press, of which Mr. Dwight Slate, of Hartford, is the originator, and which are called "sensitive" drills, have, as we all know, become very popular in this country with those who have light drilling to do, the distinctive feature of these machines being the use of the lightest possible spindles, driven directly by light belts without gearing, and the spindles being moved by a small and very light lever, this and the spindle being balanced by a spring instead of the usual weight. Of course the idea of all this is to reduce the weight and momentum of the moving parts to the smallest possible amount, the result being that the least increase in the resistance met by the drill is instantly felt by the operator, and the machine is what its name implies—sensitive. An amusing instance of the difference between our ideas and those of English tool builders, as to what constitutes sensitiveness, is to be seen in an illustration of a drill press in *The Engineer*, of London. This press is made by a prominent firm of English tool builders, and is called "Sensitive," being recommended especially for the lightest work of electrical engineers, cycle manufacturers, etc. The spindle and sleeve of this machine look as though they would weigh at least six times as much as the corresponding parts of any sensitive drill made here, and instead of the light spring, a weight and chain are used for counterbalance. Then for feeding the spindle, there is a rack on the sleeve, and a heavy hand-wheel with handle in its rim. It can easily be seen that the machine is anything but sensitive, according to our interpretation of the term, and how small holes can be drilled with it, with any approach to rapidity, is more than we are able to understand. It is perfectly safe to say that an American "sensitive" drill will drill more than twice as many No. 60 holes in a given time, and break fewer drills.

Every few years some newspaper or magazine writer takes up the subject of the remarkable cutting instruments made a few hundred years ago. According to these writers the armorers of those times possessed skill in forging and tempering entirely unknown at the present day; besides, the quality of the steel must have been something a good deal more than remarkable. As a matter of fact, some of those old-time workmen were skilled in their way, and did some creditable work, time being of but little consequence. But we do not know of a single well-authenticated instance in which one of these ancient swords has held its way against rather ordinary instruments of modern manufacture. These stories about Japanese swords, made

in the fourteenth century, cutting an ordinary sword in two without marking their own edges, which were so keen as to cut a hair, are in all probability like the stories of the wonderful shooting qualities of the ancient Kentucky rifle.

It is safe to say that there is never a time when there is not trouble between railroad companies and citizens about the management at grade crossings. If grade crossings were, once for all, abolished, all this trouble would cease. It would be a wise law that would make their abolishment universal.

It is announced that a number of American sleeping cars will be manufactured by Pullman for Australian railroads. Eighteen cars will be in the first shipment, and they will be sent in parts, which will be put together at their destination by men sent out to Australia from the works at Pullman.



Attachments to Milling Machine.

On this page we give illustrations of two attachments to the milling machine made by the Brown & Sharpe Manufacturing Company, Providence, R. I.

The first of these is a vertical spindle attachment, and is adapted to be used with the Nos. 1 and 3 universal and the No. 6 plain machines. As will be seen, it consists simply of a frame, so made as to be adapted to clamp firmly to the overhanging arm, a horizontal shaft being mounted in suitable bearings within this frame, and at the proper height that its tapered end may be placed in the spindle of the machine, the same as an ordinary cutter arbor. From this horizontal shaft the vertical spindle is driven by means of spiral gears. The attachment has been found very useful for a large range of work, such as die-sinking, key-seating, cutting T-slots, etc.

The other attachment is for use in the No. 1 universal machine, and is for the purpose of driving small stem cutters at a high

speed for light or finishing cuts. It consists of a shell, which is fitted to the hole in the spindle. Inside this shell is a small spindle, which is driven by a belt from the countershaft. This extra pulley for the countershaft, and a holder to which the belt can be shifted when not in use, are furnished with the attachment. The hole in the spindle of the attachment takes the taper shanks of the stem cutters, ordinarily used with collets in the regular spindle, and with the attachment these can be run at a speed much above that which can be attained by the cone spindle, which remains stationary when the attachment is in use. Experienced milling machine men will readily see the value and utility of this device.

Column Saw.

The sawing machine, shown in the accompanying illustration, has recently been brought out by John Royle & Sons, Paterson, N. J. It embraces most of the good features of the cabinet saw manufactured by the same firm, and which was illustrated in our issue of March 14, 1889. Although the column saw is not adapted to so wide a range of work as the cabinet saw, it is, however, very serviceable, and suitable for all kinds of work which photo-process engravers, electrotypers, printers, pattern makers, piano action and organ makers have to do, and all others who do light but accurate sawing. The machine is built upon a rigid iron column, the lower portion of which is utilized for closet purposes, while the upper portion forms a receptacle for dust, which is discharged through a spout at the back. This discharge spout affords a convenient mode of connecting the machine with an exhaust fan for removing the dust, or, when preferred, of collecting it in a box placed at the back of the machine. Slots are cast in the base of the machine for the purpose of tightening the belt. The belt shifter is arranged to pass beneath the base of the machine, and is operated by the foot of the workman.

The spindle is rigidly supported in self-oiling bearings. It is made of steel, and will carry a 6-inch saw. An adjustment is provided for maintaining relative accuracy between gauges and saw in case of wear in the spindle bearings. The hand wheel and screw, shown in the front of machine, is for the purpose of raising or lowering the table.

The floor space required is 3x3½ feet; weight of the machine, 350 pounds. The sizes of saws vary from 4½ to 6 inches, and the ripping gauge will adjust to 15½ inches. The cross-cutting slide will cut to 19 inches; size of table, 22x22 inches; tight and loose pulleys are 6x3 inches; speed of the countershaft, 650 revolutions. With each of these machines is furnished a countershaft with self-adjusting bearings, and belt shipping fixtures; a cross-cutting or "squaring-up" slide; a slitting gauge, with two removable fences, one high and one low; one wood throat for the saw, that is also removable; one saw blade for wood, and two wrenches for changing saws.

Development of a Mechanic.

BY BELL CRANK.

III.

The young man who has not the means to get a technical education has been advised to get books and educate himself by studying during spare moments. Such advice is usually given by those who have not done anything of the kind, and although it is good advice, it is not easy to follow. The daily labor, trials and discouragements incident to the life of an apprentice are mostly such that, at the close of the day, he is too tired to be able to concentrate his mind on anything requiring much mental effort, and the consequence is, that progress is very slow and uncertain.

Another thing against this method is the fact that he is trying to learn things that he has no immediate use for, and cannot put in practice, and this makes it uninteresting.

To make progress in studying under such circumstances, it is absolutely necessary to set apart a given time daily to the study of a single subject, and, if possible, not allow anything else to interfere with it. The rest of the spare time should be occupied with general reading on mechanical subjects in mechanical journals taken regularly.

It is very important in the habit of reading, not to read anything hastily, but always take the time to understand it thoroughly, or, if it seems too large or complex, it should be dropped at once, and attention given to something that can be comprehended. An excellent plan to help to a good habit in reading, is, after having read an article on a subject, to write out from memory what ideas were in the article, and then compare it and see how near it agrees in substance with what was read.

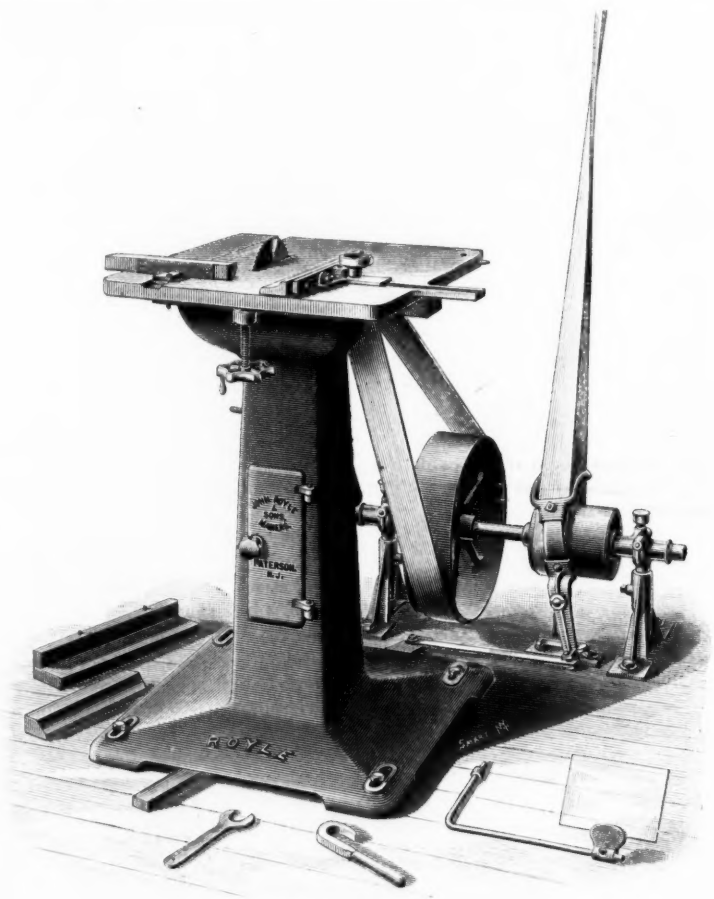
After the apprenticeship has been concluded, and the young man has a fairly good job as a journeyman, much better progress can be made in studying, because he will be able to do his daily work with much less trouble and anxiety. Also by that time he will have a better idea of the kind of knowledge needed. When self-education is undertaken, it is very important that only such studies as will be absolutely necessary should be taken up, and fortunately on this point there cannot be much difference of opinion. Trautwine says, "Nearly all the scientific principles which constitute the foundation of civil engineering are susceptible of complete and satisfactory explanation to any person who *really* possesses only so much elementary knowledge of arithmetic and natural philosophy as is *supposed* to be taught to boys in our public schools." Civil and mechanical engineering are so closely related that the same observation will apply with force to the latter, but there is a great deal of valuable knowledge locked up in books that cannot be reached without a knowledge of geometry and algebra, and, all things considered, the time spent in getting a good knowledge of these branches could not be more profitably occupied. It is not desirable that the student become expertly proficient in these studies, but enough should be obtained to enable the student to get knowledge of mechanical principles by their aid. Natural philosophy and the principles of elementary mechanics should be taken up, and also a good general knowledge of steam engineering is almost essential in mechanical engineering.

After completing the foregoing studies, it will probably be best to guide the studies in the direction of some special branch of the business. While studying geometry, a knowledge of drawing should be acquired, at least sufficient to enable one to read drawings and judge if they correctly represent the object drawn.

Some may find it difficult to keep up enough interest in the various studies to go through them thoroughly, and to those I think a good plan would be to undertake to design a machine. In doing this it would be best to avoid taking measurements from any machine for a start, but, for instance, design a crane to be operated by hand, and be of a certain capacity. First determine what kind of material it is to be made of, and in doing this compare the cost of different materials, and select what is thought will be the best at the least cost; then find the size of parts necessary to stand the strain they will be subjected to, and the best construction and distribution of materials to do the work. I think this will not fail to be interesting, for the student will readily discover that he will have to do considerable thinking and figuring before he can get any very definite lines on paper—lines that will represent what he wants. If he finds he lacks knowledge equal to the task, then he will have an interest in looking up the needed information. After completing the design, compare it with some construction in actual use, noting the points of difference, and finding, if possible, the reasons for the difference.

After having spent about three years in the shop, it will be best to get into a more favorable position, and a good place to begin is in the drafting room. It will not take long to acquire the mere art of drawing sufficiently well to make working drawings, and more than that is not necessary, unless one expects to follow drawing for a living.

There are many opportunities for gaining knowledge in a well-conducted drafting-room, for that is where the original work is done, and where the best mechanical ability about the place is supposed to make itself manifest. In some shops the draftsmen are mere copyists, being furnished with figured sketches from which drawings are made, and when that is the plan always followed there is little chance to learn anything except the simple art of drawing. In other shops the draftsman is given a general idea of what is wanted, together with a few dimensions, and is then left to work out details, and that is the best kind of a place to learn in.



COLUMN SAW.

At this point I wish to impress on the mind of the learner the great importance, in fact, the absolute necessity of following strictly the instructions and wishes of whoever is in charge of the work in hand. I have known young men to lose excellent chances to learn and become useful and valuable, by their persistency in continually proposing their own ideas of how things ought to be, instead of following those of the designer in charge. It is no harm to make suggestions where the designer seems to favor it, and has not fully decided on a point in question, but it is wholly unadvisable to raise any objections to plans which have been adopted.

I do not mean by this that a man is not to have ideas of his own, for no one will ever

amount to anything who has not, but he must be extremely careful to keep them to himself, when there is any possibility that they will not be welcome to his superiors.

One of the most fruitful sources of aggravation to superintendents and others in charge of men, is the trouble to get those who will honestly and faithfully carry out their plans according to instructions. The lesson of obedience may be a hard one for a young man to learn, but he must learn it before he can ever hope to be a director of mechanical enterprises.

The Nuttall Trolley.

We herewith illustrate a new style of electric railway trolley, manufactured by R. D. Nuttall & Co., of Allegheny, Pa. This trolley is an entirely new departure, in which it has been the aim to combine simplicity and effectiveness at a reasonable cost.

As will be seen by the accompanying cut, the springs of this trolley are compression springs, instead of tension. By the peculiar construction the pressure is sensitive, and is increased slightly when the pole is nearly perpendicular. The pole swings both ways, thus insuring a straight pole at all times. When a pole has been used for any length of time in one position, it has a tendency to bow. When this takes place, the pole can be thrown to the other side by swinging the base on the pivot at the bottom, as the trolley is swiveled the whole way around, or, in other words, it can be turned in a complete circle on the top of the car.

In the wheel an aluminum bronze alloy is used, which gives excellent contact and great wear. These wheels are bushed with graphite bushings. A wooden pole is used, a great advantage over the old form of iron pole, as it can be renewed at a very small cost, and is also very light. Wood being so much lighter than iron, it requires but one-fourth the tension to keep it on the wire and give good contact.

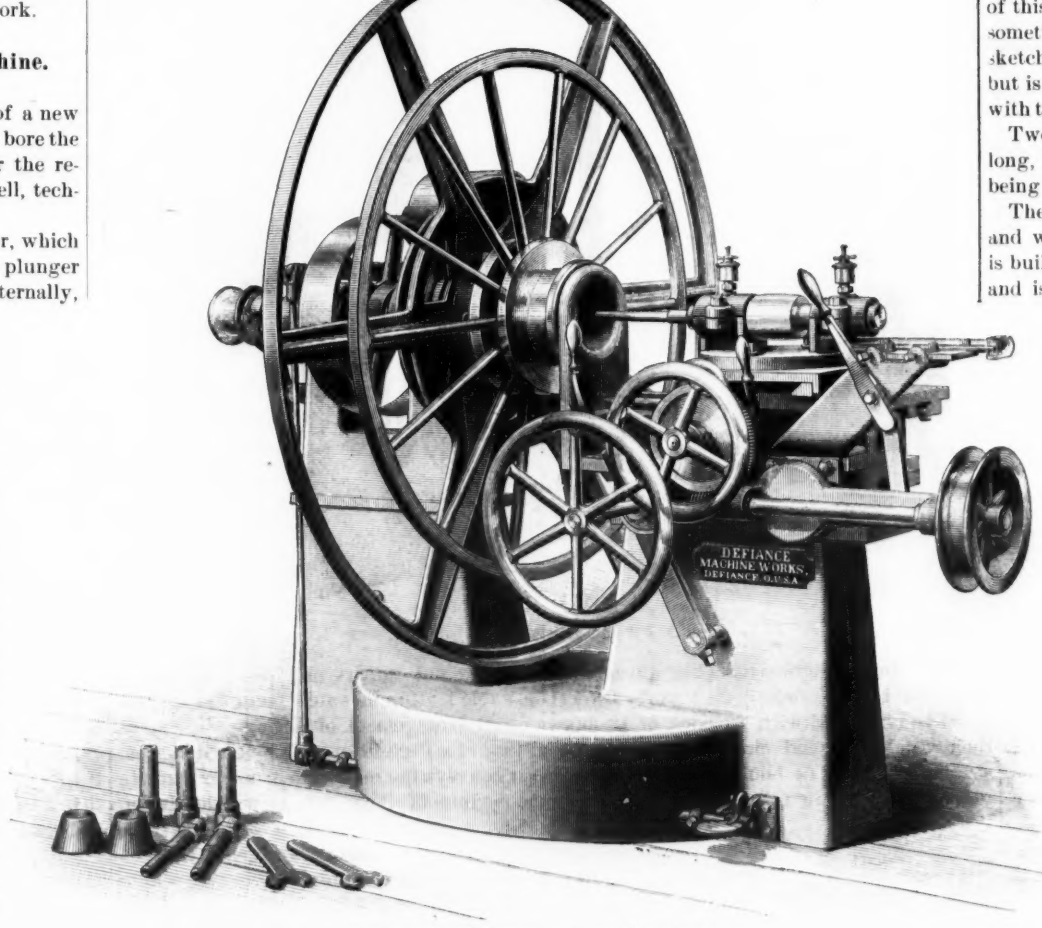
The trolley is constructed of malleable iron and brass, with springs tested far beyond the limit required for this class of work.

THE NUTTALL TROLLEY.

Automatic Wheel-boxing Machine.

The accompanying illustration is of a new machine, the purpose of which is to bore the wooden hubs of vehicle wheels for the reception of the cast-iron sleeve, or shell, technically known as the "box."

The wheel is centered by a plunger, which is forced forward by a spring, this plunger being hollow and of a conical form internally, so that, as it comes against the end of the hub, the wheel is centered. The felloe is at the same time, trued sidewise by coming against the radial arms shown, and the wheel is driven by the two revolving padded disks, which bear upon the spokes near the hub, the outer one of these being held in place by pressure brought upon it by a lever, and running upon a bearing composed of forty $\frac{5}{8}$" steel balls, to reduce friction. The time occupied in thus chucking the wheel is not over five seconds, and upon the machine being set in motion, the wheel is revolved at two hundred turns a minute, while the cutter, which revolves at five thousand turns, is automatically fed through the hub on a line which conforms exactly to the outline of the box which is to be fitted. This is secured by the use of a former, which is placed at the back of the slide, by which the cross slide is moved at the proper rate, as the tool advances, to make it follow the desired outline. The feed is automatically thrown out at the completion of the boring. The machine is as carefully designed and built, and provided with as liberal bearing surfaces, as the best practice in machinists' tools would call for, and constitutes, we believe, an entirely new departure in the manner of doing this work, and one which will conduce very much to greater accuracy of work, as well as rapidity, the machine being easily capable of boxing 600 wheels per day. Provision is also made for cupping both ends of the hub at the same time to any size and shape. The machine weighs 3,000 pounds, and countershaft, with all necessary accessories, accompany it. It is made by the Defiance Machine Works, Defiance, Ohio.



AUTOMATIC WHEEL-BOXING MACHINE.

The Patent Centennial Celebration.

Elaborate arrangements have been made to celebrate the beginning of the second century of the American Patent System at Washington on the 8th, 9th and 10th of April next. All of the railroads leading into the national capital have reduced their rates for the occasion, and a great crowd is expected. President Harrison will open the celebration, and the literary exercises will be presided over by some of the most eminent inventors in the country. Twenty addresses upon the different phases of invention will be delivered by men who are famous as masters of the subjects they will discuss. A national association of inventors and manufacturers of patented articles will be organized. There will be a grand reception at the Patent Office by the Secretary of the Interior and Commissioner Mitchell, at which it is expected Cyrus W. Field, Thomas A. Edison, George Westinghouse, George M. Pullman and others will assist. There will be a military parade, an excursion to Mount Vernon, a planked shad banquet at Marshall Hall near Mount Vernon; and the Navy Yard, the National Museum, the Patent Office and other interesting national establishments will be open to the visitors.

This is the first time in the history of the republic that the inventors have celebrated.

The committee in charge of the celebration announce that, in view of the limited seating capacity of the largest public hall in Washington, it has been found necessary that admission to the public meetings, at which addresses will be delivered by distinguished speakers, will be by ticket only. This rule will also hold for the public reception to be given at the Patent Office, and for the excursion to Mount Vernon. Persons desiring to attend the meetings, and participate in the reception and excursion, should make application at once to J. Elfreth Watkins, Secretary of the Executive Committee, 811 G street, N. W., Washington, D. C.

Joseph Francis, now ninety years old, is said to be the only inventor who has received the thanks of Congress. His inventions were in the way of life-boats and life-saving appliances. Mr. Francis has received a medal from Congress, which reflects, in the giving, credit upon that body.

Letters from Chip.

Mr. Editor:

Some time ago there appeared in your columns an article on the large pumping engine, the "President," located near Allentown, Pa., stating it to be the largest stationary engine in the world. A newspaper article on the same subject, among my clippings, gives some widely different data, so that since the communication in the AMERICAN MACHINIST, above referred to, I have had a desire, or rather a curiosity to examine this huge engine, and with a pair of calipers and a two-foot rule obtain from actual measurement some of its leading dimensions.

The engine is not the largest in the world as far as dimensions of cylinder is concerned, but it is the largest, if we take bulk and weight into account. Armed with a pair of 24 inch calipers the writer recently made a special trip to the zinc mines, and, through the courtesy of Superintendent Eudy, of the Friedensville Zinc Company, was enabled to obtain the following data, which may be of interest.

The engine, designed by John West, in 1868, and built by Merrick & Sons, of Philadelphia, is rated at 3,500 horse-power, though I question whether it ever developed more than 2,500.

Mr. West also designed another pumping engine, located at Hanover, Germany, which is very similar to this one, the cylinder of the Hanover engine being 112 inches in diameter, and the stroke 10 feet.

The steam cylinder of the Friedensville engine is 110 inches in diameter, the stroke being 10 feet; its piston-rod is 14 inches in diameter, and is connected to the piston by the mammoth nut referred to by X. A duplicate of this nut is kept on hand in case of need, and was found to be of the following dimensions: Diameter of collar, 24 inches; distance between flats, 21 inches; height of collar, 7 inches; total height of nut, 14 inches; largest diameter of thread, 15 inches—which would give a weight of about 800 pounds (not 1,600). A peculiarity of this nut was its thread, which was what is sometimes called a half square, as shown in sketch (page 4.) A wrench 12 feet long is used, but is not operated by 20 men; three or four, with the aid of a winch, are all that are needed.

Two connecting rods are used 42½ feet long, 15 inches maximum diameter, the rods being trussed for side thrust.

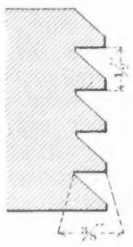
The two fly wheels are 32 feet in diameter, and weigh 64 tons each. The walking beam is built up of 4 main sections bolted in pairs, and is 40 feet long, 8 feet deep in the center, and is said to weigh 120 tons. The two bearings for beam are each 24 inches diameter by 24 inches long, the brasses are 2 inches thick, and are cooled by a stream of water which flows through them. The latter were cool when I measured them, but the engineer said they would heat up very quickly if the water were turned off—this seemed surprising at first, as there was only a partial revolution of the shaft, and only 10 strokes per minute; but a little calculation showed what an enormous pressure was on the brasses.

The number of strokes per minute is normally 6½, that is, 6½ strokes will keep the mines fairly dry, but if a stoppage occurs the water will fill up, and the engine will have to run faster to make up for lost time. 14 strokes per minute is about the maximum speed at which the engine can be run; as this gives a piston velocity of 280 feet per minute, and as small pumps generally run about 100 feet per minute, it will be seen that this engine is not moving so very slowly after all. A battery of twenty boilers supplies the steam, which was at 50 pounds pressure (generally 40 to 45 pounds is used). Assuming the pump plungers to be three—30 inches in diameter, and one—22 inches diameter, the discharge each stroke, disregarding leakage and slip, would be 1,328 gallons; at ten strokes per minute

the discharge would be 13,280 gallons per minute—over 19 million gallons per day of 24 hours.

Mr. Sanders has evidently had an experience with catalogues, nor is he alone in this.

Every one who has occasion to use trade catalogues has been bothered more or less with the varying sizes in which they are printed. To be of use, catalogues must be accessible.



Brown used to keep a catalogue box under the table in his office, and whenever a new catalogue came in it was placed in this box. Every once in a while the office boy was set to work to arrange the catalogues in separate piles according to their size and shape; but when, a few days later, Brown would want to show up the Worthington condenser to a customer, and would have to go through nearly every pile before he found the circular wanted, there wasn't much neatness or order left in the box. Sometimes Brown would tell the boy to look up a certain machine, and would get mad because the youth spent half an hour at the box without finding the desired catalogue; then Brown would spend an hour or more himself, breaking his back leaning over the box before he could find his machine. Well, he finally concluded to change all this, and after carefully thinking the matter over, he decided to make a case containing twelve compartments in which he would place his catalogues in the following groups:

Boilers—Feed-water heaters, injectors, condensers, boiler fittings, etc.

Books—Scientific and technical, instruments and drawing-room supplies.

Electrical machinery and electrical supplies.

Engines—Steam, gas and hot air.

Forging machinery—Steam hammers, blowers and fans.

Grinding machinery.

Machine tools—Lathes, planers, drills, milling machines, etc.

Miscellaneous.

Pumps.

Punch presses and sheet-metal forming machinery.

Shop supplies—Files, oils, screws, sheet metal, bar-iron, etc.

Wood-working machinery.

The question of size for the compartments bothered Brown, just as it has bothered the rest of us. Here was a catalogue of pumping machinery, which measured 11x14 inches, and further down in the pile was another, which measured 3¼x5½ inches, while between these limits ranged as many different sizes as there are pumps manufactured.

To make the case large enough for the 11x14 inch sizes would fill the bill as far as capacity was concerned, but this made it too large for convenience in a small room, therefore Brown compromised matters, and built the case with the pigeon holes 11½x10 inches; all catalogues that would not go in these compartments otherwise, he folded—much to their detriment.

There isn't much system connected with this arrangement, but what cannot be found under the general heading of subjects tacked above the pigeon holes is readily obtained by the use of an alphabetical list of special subjects, fastened to the side of case. On the other end I noticed another list, and this was an index of manufacturers, stating in which compartments their catalogues were to be found.

A little drawer has been added to the case as a growth of the system, and in it I found a number of cards, a set of rubber type figures about ⅛ inch high, and a rubber stamp bearing this legend,

RETURN TO NUMBER .....

I could see the advantage of the stamp and figures, for all the compartments were numbered, and every catalogue was marked conspicuously, "Return to number .," and had a figure appended in the blank place, but Brown had to explain the use of the blank cards, which were of stiff pasteboard, and measured about 6x9 inches.

"Suppose," says Brown, "that I am looking for a cutter grinder, naturally we would look under the general heading, 'Grinding Machinery,' but there we do not find just what we want, so we refer to the card, one or more of which is found in each compartment. Here I find:

Grinders—Universal, see Brown & Sharpe, machine tools.

Grinders—Cutter, see Brown & Sharpe machine tools.

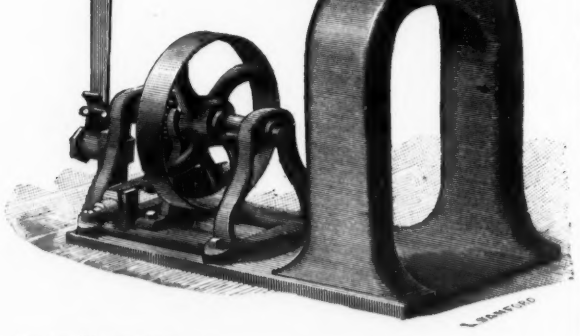
Grinders—Cutter, see Garvin, machine tools.

Grinders—Cutter, see Hill, Clarke & Co., machine tools.

The subjects must necessarily overlap, and I find in lieu of duplicate catalogues this card arrangement works well, and is really not much trouble. Of course, an Index Rerum is better, but who in this busy shop life is going to stop to index a catalogue?" I liked Brown's system first-rate, but thought what a big advantage it would be all around, if manufacturers could be impressed with the idea of issuing their catalogues and circulars of uniform size, which could be bound into convenient volumes under their respective heads.

Yours truly, Chip.

A sensible woman, whose years have covered a good deal of past history, and who has always, by circumstances, been obliged to earn a living, recently remarked, in the hearing of the writer, that the sewing machine had been a curse rather than a blessing to women. This ought not to be true, but it may be, all the same. Still, admitting this, it does not follow that the trouble is with the sewing machine. This woman remarked that when work was done by hand the cost for making a white shirt was generally something more than a dollar. Now, a woman received about a shilling for the same work. The sewing machine, driven by power, rattled off fourteen hundred stitches a minute, and kept the nerves of the operator at a tension that soon wore her out, in all of which there may be much truth.



Drop Hammers.

Drop Hammers.

We present herewith illustrations of two machines recently brought out by Miner & Peck Manufacturing Company, New Haven, Conn., who, as successors to Beecher & Peck, are sole manufacturers of the Peck drop press and Peck lifter.

Fig. 1 represents a drop press designed for stamping and forming fine light work. Its construction will be readily understood from the illustration. It is all contained on one bed-plate, and being placed on a foundation and entirely disconnected from building, does not impart any jar to it; a very desirable feature in watch factories. It has a novel arrangement of lifting device, consisting of a Peck lifter with reversed action, that conveys the motion to hammer through the medium of a light wooden walking-beam.

The anvil is of such a form that the operator can sit while at work, and the machine being operated by foot treadle, allows of the use of both hands in handling the work. The hammer is a square bar of forged crucible steel planed to fit nicely the brackets through which it slides.

The dies are held by accurately fitted poppets, and a round steel block is inserted in anvil for die to rest upon.

One of the largest watch factories in the country has a number of these machines in operation, and reports excellent results.

Where a hammer, with all the features of accuracy, but to lift hammer by foot or hand with belt over flanged pulley, is desired, the machine as shown in Fig. 2 is furnished.

For very accurate work, such as watches, jewelry and kindred lines, these machines are especially recommended.

Foundry Management.

By Charles Smith.

The successful operation of a foundry depends to a great extent on the hearty co-operation of manager and employes; systems, rules and practices, lose their effectiveness if that essential is lacking, but a good system, backed by an energetic foreman or manager, and willing mechanics, places a shop at once in a progressive position.

It would be found quite a difficult task to submit a plan for general adoption, looking toward keeping an accurate account of the daily working of a foundry, that would meet with general acceptance among our foundrymen.

It could hardly be formulated in such a way as to strike the situation in every shop, and fit the place exactly; modifications to suit the practices of the shop would necessarily have to be indulged in; knowing all this, the following is presented, trusting that some progressive foundrymen may adopt it, or part of it, or improve it to fit their positions; for anything of such nature indulged in by manufacturers or foremen tends toward teaching a better understanding of the workings of our foundries.

AMERICAN ENGINE COMPANY.

Iron Foundry Daily Report.

New York City, *March*, 1891.

No.	Name.	Kind of Work.	Good lbs.	Bad lbs.

Total weight.....

Percentage.....

Quality of Iron.	Weight	Returns.	Weight
Ohio.....		Good Castings...	
Southern.....		Bad Castings...	
Scrap Machinery		Sprues and Gates	
Sprues and Gates		Cupola and Mill Scrap.....	
Total charged....			
Returns.....		Total Returns....	
Loss in Melting..		Coke	
		Coal	
Per cent. of Shrinkage.....		Total	
		Ratio of fuel to iron melted...	

Remarks

....

Foreman.

If the report shows an unfavorable result, study well the methods employed in getting out the work; have the facing prepared before it is actually needed, the cores made ahead, flasks cut or barred to suit the work contemplated, and if you look around a little you will find the progressive and successful managers in our foundries have the castings taken out of the sand after the molders have left the shop, and the sand cut up, and everything made ready to commence work when the whistle blows in the morning. Let your last resort for gain be in trying to make more money, or a better showing, through forcing, abusing or driving the men. A lazy man will not learn the trade of molding; he recognizes early the hard work attending it, and drops out before he becomes a mechanic, therefore, the mechanics at the trade being all right, handle them right. Let them understand plainly that an honest day's work is daily expected, and that you are satisfied when you get it. Pay the standard wages, and try to secure and hold men that will be reliable and faithful. Don't forget your manhood and swear and tear when a kind word of masterly, authoritative guidance carries more respect, and is far more effective. The powers of a Czar, coupled with the characteristics of the mule, never yet made a successful manager. Get the confidence of the men and hold it.

If on piece-work, give a price that will be square all around, alike to manufacturer and mechanic. If you have made a mistake, and given a greater price than (you find afterwards) circumstances will warrant, tell him squarely so before cutting the price. If you have given too low a price, and he can-

not make a fair day's pay, be equally prompt to give him fair remuneration. Acknowledge squarely when you have made a mistake. One of the easiest things in the world is to be mistaken. Never have pets or favorites. Jealousies, whisperings, black looks and curt replies, all find breeding places in the nests feathered for the pets.

Treat men in this way, and there will be less of unions and less of strikes; for there will be no cause to unite and no cause to strike; and if moulders will unite, let it be to discuss matters that will tend to elevate themselves and their trade. Read papers and books that treat on molding and mechanics. Without perceiving it, you will be cultivating yourself and preparing for something better at your trade. It may come in the shape of a rise of a quarter or half dollar per day in your wages, or may come in your promotion to a foremanship in your own or some other shop, but when it does come, let not the opportunity find you lacking in the qualities which your promoter thinks he recognizes when he selects to serve or advance you.

Daily your worth is watched and weighed in the eye of the foreman, and if you show yourself worthy of promotion, or handling the best work of the shop, you are sure to get it. He cannot afford to do otherwise; his success as foreman depends on the excellence of his management and work, and if you are one of the leading instruments helping him to attain it he cannot afford to ignore you. If you are not advanced as fast as your estimation of your ability seems to justify, don't sulk; it will only tend to make matters disagreeable all around, and remember that it takes years and years (even when employed on good work), with close attention and favorable circumstances, to make a good all around molder.

Every molder should be given a stamp bearing his number, wherewith to stamp every mold he makes. It answers several purposes, for it enables the careful molder to establish a reputation for good work throughout the entire establishment, his number advertising his work wherever it appears. It enables the weigher to get correct returns when weighing up the cast and crediting up weights to the several molders. It enables the foreman to detect the maker of a poor casting, even though it has passed inspection, and does not show up poorly for months after being made.

A stated formula for charging the cupola should be written on a blackboard and placed on the cupola scaffolding for the melters' guidance. This can be copied into the daily report the morning after the cast. Just before wind time, or about when the molders are getting through their molding for the day, the foreman or some authorized person can go through the shop and take the number of flasks put up by each molder, also the name and number of pieces molded during the day. A copy of this report is handed the weigher, who fills in the weights to the pieces named.

In connection with the illustration of the wheel-boxing machine shown elsewhere in this issue, the Defiance Machine Works state that eight million wheels are annually made in this country for vehicles drawn by horses, exclusive of those which are used on farm machinery, etc. When, in addition to this, we consider the number of wheels made for vehicles not drawn by horses—bicycles, baby carriages, etc.—and those which are drawn by some other form of motive power, it is seen that we are a nation that rides.

At the last meeting of the Electrical Section of the Franklin Institute a very interesting paper was presented by Dr. Wahl, conservator of the section on aluminum. Beginning with Castner on the chemical side of the question, he traced the progress of the cheaper production to the present time, and illustrated the methods of Cowles, Hall and others. After showing the different methods he reproduced a tabulated account from a recent address by one of the electrical producers, which estimated the possibility of producing the metal in large quantities at a cost of twenty cents per pound.

Dr. Wahl had also prepared a tabulated account of the production by the chemical methods, and in view of recent improvements in the production of the reducing salts he thought it as probable that it might be produced as cheaply by the chemical as by the electrical methods.

The section has just been organized by the electrical members of the Institute, and with Professor Houston as president, and such members as Dr. Wahl, Carl Hering and others, the prosperity of the new section seems to be assured.

LETTERS FROM PRACTICAL MEN.

Melting Iron.

Editor American Machinist:

Under this heading, in your issue of March 5th, Mr. F. P. Wolcott says: "In a 36" cupola, seven to nine pounds of iron to one of fuel is good melting; but in a cupola that lines up 48" to 60", anything less than nine pounds shows a defect in arrangement of tuyeres or strength of blast, or in charging up."

I think he is misleading in making the above assertion, for the reason that an inexperienced person would naturally conclude that, to economize in fuel, all that is required would be a cupola 48" to 60" in diameter.

I think Mr. Wolcott would find it a difficult task to take, say a five-ton heat of iron, and melt it with less fuel in a 48" cupola than was required to do the same thing in a 36" cupola.

Of course the writer has no doubts but what eleven pounds of iron to one of fuel can be melted, but iron melted at that ratio is generally dull, and unfit to pour light castings. If persons claiming to melt eleven to one would give quantity and quality of scrap used, fluidity of iron, etc., it would be valuable information; for where work is such as not to require very fluid metal, the low percentage that some may use successfully would not be advisable for others to practice.

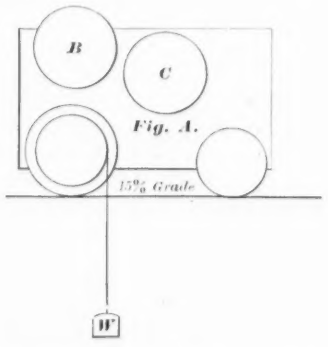
GEO. O. VAIR.

Milwaukee, Wis.

Another Traction Engine Problem.

Editor American Machinist:

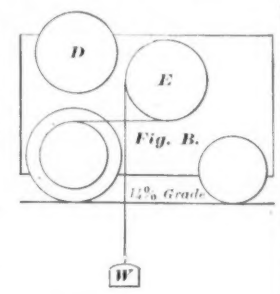
"That traction engine" brings to mind a discussion which lasted several weeks in our shop, and finally divided the boys so evenly that a model was improvised and tested. The question was whether there was any advantage in applying the power at the top of the driving wheel, or on either side level with the axis. The experiments gave such decided results that I am tempted to submit them to your readers. A track ten feet long, of 4-inch gauge, was provided, one end supported on a post so that the other end could be raised or lowered to obtain various grades. On this the model was mounted, the motive power being the weight *W* attached to a



braided silk trout line, which one of the boys fished out of his tool-box. The rolls *B*, *C*, *D* and *E* were turned up of hard wood with ¼-inch steel journals inserted, the proportions being about as given in the sketches. Style *A* representing the engine where the pinion engages the driving wheel level with its axis, and in front would ascend a 15 per cent. grade with about the same velocity as style *B* or *C* would ascend 14 or 13 per cent. grades respectively. The weight *W* represented about 75 per cent. of the total weight of model, including *W*.

The arrangement of the model is due to a level-headed mechanic who was sure that there could not be any difference, and when the results began to show that style *C* would not move at all on the 15 per cent. grade he carefully tested the carrying rolls *E* and *D*, so that the correction for their friction under the load *W* is deducted in the results given above.

A. H. LEFEBVRE.

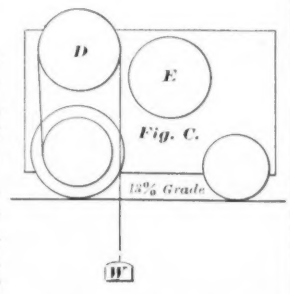


That Pump Question.

Editor American Machinist:

Referring to the query of H. T. S., New Orleans, La. (113), I presume he is running a centrifugal pump. If he can observe the discharge he will notice that when the river is high the pump handles very nearly double the quantity of water, and the action of this class of pumps is such that a given speed produces exactly the same pressure in the case where the fan revolves, whether the outlet is free or entirely closed. Therefore, if the pump was speeded to just raise the water twenty feet it would absorb exactly twice as much power when raising it only five feet.

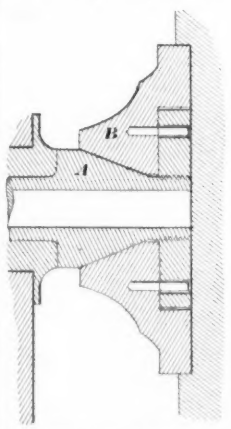
A. H. LEFEBVRE.



Interchangeable Chucks.

Editor American Machinist:

I have perused with pleasure the articles under the above title that have lately appeared in your paper, and send you a drawing of a way of fitting that is simple, cheap to make, accurate, and easily repaired should it become injured by accident or long and rough usage.



The cone *A* should be hardened and ground; the fitting *B* should be ground by a plug ground at the same time (same setting of the compound rest) as the spindle, and the two afterward ground together, which is easy when the nut is made separate as shown in the drawing; the nut must have some play in its recess of the face-plate *across* the spindle, but should be just a fit *endways*.

FRED W. SALMEN.

Leeds P. O., Sioux City, Ia.

Traction Engines.

Editor American Machinist:

I have had nineteen years of experience as machinist, engineer and tool maker; I have had some experience with traction engines, and never have seen one light enough to raise up in front without a load. If the load is coupled to the engine below the back axle, the tendency is to force the front end down. Several years ago I saw an Ohio farmer loop a chain round the fire-box high enough to touch the round part of the boiler. To this chain he attached a threshing machine, a tank, and a two-horse wagon. The result was that when he started the engine it reared up like a balky mule. He cursed the engine until I showed him how to wrap the chain around the axle on each side, and tie a knot under the fire-box. The engine worked all right, and the farmer came to the conclusion he had learned something.

M. E. T.

[The question which has been discussed in these columns relating to traction engines relates simply to their *tendency* to lift in front; this tendency may be greater in one engine than in another, though neither of them will actually lift under ordinary running conditions, and it is, of course, important in designing such engines to know what particular arrangements of the mechanism do or do not increase this tendency.—[Ed.

Another Born Mechanic.

Editor American Machinist:

In your issue of March 12th appears a letter from "A Born Mechanic," in reply to "Victim," which was full of interest to myself, for in former years my success as a maker of wooden locomotives, threshing engines, etc., led me to believe that a brilliant career awaited me in the mechanical world.

But time and its rude shocks have dispelled those fond illusions, and contact with practical machine construction leaves me without the connecting link which leads from wooden locomotives to steam engines or machine tools.

There are some notable examples of men who have achieved greatness as leaders in mechanical pursuits, and who never learned a trade, but the number is comparatively small.

Constant study, practical knowledge, and a desire to excel, in those who are so fortunate as to be placed in positions where they may acquire the knowledge so requisite in a successful mechanical engineer, is, in my opinion, the road to success.

OHIO.

The Schiele Bearing.

Editor American Machinist:

Your correspondent, Mr. W. H. Harrison, writes very flippantly respecting what are called "Schiele bearings," and is no doubt entitled to a personal opinion respecting them, but it does not appear from his letters that he has had any experience whatever in the use of bearings of the kind, nor does he seem to be aware of what may be called the *status* of this form for thrust bearings in modern practice.

His remarks respecting the two machines at Boston, with interrupted Schiele bearings, show this.

One of the principal, if not the principal tool making firm in this country, mount all their vertical spindles on such bearings; at least, all that sustain much thrust or weight; I mean Messrs. Bement, Miles & Co., of Philadelphia, formerly Bement & Dougherty; but even this practice is not necessary to support an argument for having speed and wear, or speed and compensation, in proportion.

If Mr. Harrison wants to resist thrust successfully with radial faces, the shaft of a marine propeller offers a good opportunity. He could with advantage, no doubt, hunt over the history of attempts to resist such thrust with end screws, plates, or other kinds of radial faces.

The rotary engine, too, is another example, where surfaces at varying velocity with uniform compensation would be desirable. I will mention also sustaining the heavy water wheels at Pond Moss, or indeed almost any case where heavy thrust is to be resisted with ordinary material and lubrication.

The shallow collars that are now commonly used for such purposes, and universally used in the case of propeller shafts, are no more than an approximation to the propositions laid down by Mr. Schiele, respecting his "curve of equal tangents," whereby speed, and consequently wear, were compensated by corresponding adjustment, or equal adjustment.

The Schiele form of bearings for end thrust is correct, as is well known by at least a large portion of constructing engineers, but are expensive to make, and not necessary for ordinary duty. At the Industrial Works, Philadelphia, before mentioned, the matrices are cast of soft lining metal to save the expense of fitting, and is almost the only use of cast bearings in the works. The same reason, no doubt, causes Messrs. Brown & Sharpe, of Providence, to employ an approximation of the Schiele bearing in some of their machines.

Finally, I do not think that many of our best mechanics will concede Mr. Harrison's method of settling such questions by his "opinions." If he wants to contend that radial faces will run under pressure, let us have the theory and facts, and his own experience, if any. If Mr. Schiele was wrong in his assumptions, let us know why and wherein. J. Richards.

San Francisco.

Some Notes on Shop Work.

Editor American Machinist:

When running a boring mill, I have found it very convenient, and a saving of much time and danger, in setting work, to locate the center of a pulley, wheel, or whatever permitted, with a pair of large beam center calipers, pursuing the same course as in centering any small work with the maphrodites. After scribing the center on a piece of wood driven into the core hole of hub, I would then place in the tool holder a pointed tool, which I knew was central with mill, by marks previously located. Having these two essentials properly fixed, adjust or move the work over until the center located therein coincides with the pointer. If properly leveled and located, clamp it, and without further trouble the job is trued up. This plan is especially useful on heavy work.

I have often thought that the intervention of a friction sleeve, or its equivalent, on the feed rod of a shaper or slotter, would in some instances save the breaking of important parts, by slipping and stopping the feed, if interrupted from any over-strain, which often occurs, and which almost any slotter will bear witness to upon an examination of the feed gear; this usually happens from tools, wrenches or work falling or getting in the way of table. We might say a man has no business to leave things in these traps, but in fact they do nevertheless, and the result is broken gears, strained feed apparatus, etc. I have an occurrence in mind where the rock arm on a Niles slotter was broken by a wrench being caught out of place. It would appear as if some relief should be provided for this emergency.

Occasion has suggested the query why the lower edge of a slotter table should not be indexed with a series of holes in place of or in connection with the degrees usually marked thereon. This expedient would in many cases be of convenience, especially where no dividing head is to be had. The slotter certainly is a poor tool to cut gears on, but, in the absence of better facilities, serves a purpose.

I saw a good arrangement at D. & R. G. R. R. shops, Pueblo, Col., which might be generally copied to an advantage. It consisted of a simple box with slide ends, pivoted centrally under the lathes; the boxes were long, extending almost full length under them. At the center of box was a division; when turning iron one end was used, if brass, the opposite end was swung under the work, serving a matter of cleanliness, and saving material.

Pulling and handling blocks around an engine being jacked up or down is at best an awkward and cumbersome job, while more or less splinters usually find their way into the hands. The neatest thing I ever saw to handle these blocks with is a pair of light steel hooks, similar to those used by icemen; with these you grab the blocks, and out they come.

In a recent issue, a leather dog was described for holding work back against the live center. As this is a very frequent part of lathe work, something quick and handy should be provided. The leather dog is as good as anything I have seen for medium heavy work; a clamp on one side of the dog is not an unusual makeshift, but it springs the work out of truth, as well as out of balance, and is dangerous. For very light work two strong rubber bands, extending over tail and set-screw of dog, and around the arms of driver plate, will, in ordinary cases, hold work for facing, centering and boring all right. It will also be found a useful expedient when much screwing and unscrewing of dog is necessary; you simply loosen the set-screw, and the dog is drawn back to plate, and stays there until wanted again.

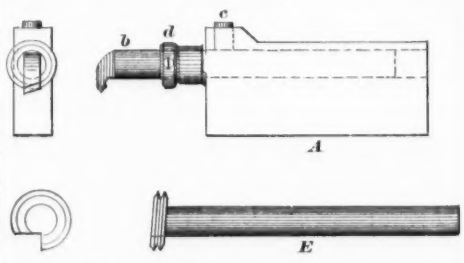
In setting tools for finishing a wrought-iron or steel shaft with coarse feeds, especially if it be of considerable length, I have found a great benefit derived in the way of more uniform finish, by setting the tool at an angle of about 45 degrees, to the work at either side of tool-post; in this position the action is peculiar, and in some respects similar to that of a spring tool; the same tool ground square in front, and placed at 90 degrees to the work or straight ahead, will chatter the work in most instances, the lines no doubt being too rigid and unyielding.

One of the most sensible and profitable departures from the ordinary rut that has come under my observation lately, is a good set of machine bolts of suitable length and size kept in a convenient rack in the tool-room, and subject to check. If the time lost by machinists hunting bolts and nuts, as well as material lost by proprietors in useless bolts, could be computed in dollars and cents, no doubt quite an astonishing result would be obtained. L. C. Sharp.

Fox Lathe Tools.

Editor American Machinist:

In the issue of February 19th Mr. Colvin has an article on tools for brass work, and I heartily agree with him when he says that the turret can be used to do accurate work; but I would add in order to do good work on the turret we must have good, careful men on them, and my experience has been that such is not usually the case. In speaking of thread tools for Fox lathe work, Mr. Colvin says, "Few Fox lathemen take the time to either grind or set the tools properly." While I must admit there are a great many men that are careless in this respect, I know a great many that would not think of either grinding or setting a thread tool except by a thread gauge, and I think if foremen would be more careful to properly instruct apprentices when learning to cut threads this evil would be lessened to a considerable extent. Enclosed find sketches of some thread tools which I have found very convenient. *A* is the holder, which is held



in the lathe in the usual way; *b* is the thread tool, which fits hole in holder *A*, and can be adjusted to any length desired; it is held in the holder by the screw *c*; *d* is a collar that fits the thread tool, and is fastened wherever desired by the screw shown; the advantage of this collar is that the tool can be removed from holder and ground a number of times *on its face*, and put back in exactly the same place without difficulty; a chaser can be used if preferred to the single point, as shown at *E*, which, I think, will need no further explanation; care must be taken, however, in cutting right-hand threads to cut the thread on the chaser left-hand for outside work. I also find this holder convenient for holding tools for boring and threading work on the engine lathe. M. E. B.

Core-box for Making Babbitt Cores.

Editor American Machinist:

The accompanying sketch shows a cross-section and plan of a "babbitt" core-box; that is, a core-box to form cores to be used on bearings, or other surfaces requiring babbitting. By referring to Fig. 1, the method of making those cores will be readily understood.

After they are turned out of the box and dried, the wire nail in each core enables the molder to secure them easily to any part of a mold's surface. They can also be attached

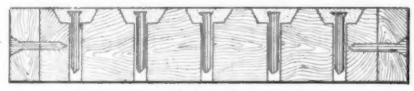


Fig. 1.

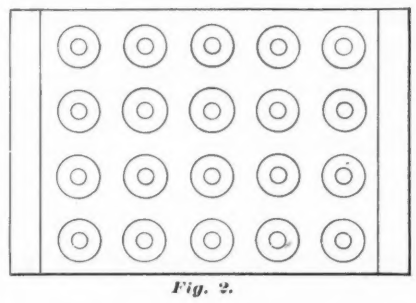


Fig. 2.

to stock cores, in cases where castings are babbitted instead of bored. The number of cores that can be made in one box or board is only limited by the size of core plates you wish to handle. Geo. O. Vair.

"The Born Mechanic."

Editor American Machinist:

"Born Mechanic's" reply to "Victim's" communication reminds him of the two actors who, having paid the debt of nature, approached the gates popularly supposed to be in charge of St. Peter, and asked admittance. The first one was refused, on the ground that no actors were admitted there, while the second one, nevertheless, readily passed in. In reply to the explanation demanded by the one who had been refused he was informed that his companion was not an actor, but only thought he was one.

"Victim," in his article, did not deny the existence of the born mechanic, neither did he intend to detract from his merits, but he did intend to faintly illustrate some of the idiosyncrasies of the individual who *thinks* he is a born mechanic, when in fact he is something else.

"Victim" is a very humble person, and not addicted to "putting on airs"; were he, he might relate some astonishing incidents of his early career, and perhaps pose as a six-year-old infant prodigy. His humility is perhaps largely due to the fact that, while a varied experience of over twenty years has established his reputation as a mechanic, it cannot be said of him that he 'has *made money*.

With no desire to prolong a fruitless discussion, "Victim" will only say that the world will probably wag right along, regardless of the opinions of either "Born Mechanic" or himself. Victim.

Pattern Work—Tying Knots.

Editor American Machinist:

We may safely say that all pattern makers are familiar with the ordinary method of using beeswax for "stopping," and varnishing with shellac, but having a number of patterns of rather large area to be varnished, and at the same time busy on other work, I had the painters take them in hand, and suggested they should give them a coat of quick-drying paint, made as follows: White lead and a little black, ground in japan, and thinned with turpentine. It dried in an hour, and the surface was left smooth; whereas the first coat of shellac raises the grain of wood, and must be cut down with sandpaper, which, to say the least, is very tedious, especially if the work has many holes, angles, etc., for stopping nail holes, and filling in internal angles, and for other work which we should use beeswax. I proposed white lead, mixed with ordinary putty and hardened with whiting, which answered every purpose. As to the difference in cost, I think we should find paint and putty the cheapest. After the patterns were smoothed and stopped, just one coat of shellac was given, which removed any tackiness that might exist.

While writing, I would like to say a few words about tying knots. I have no reference to those tied with a tongue, but such as the mechanic finds convenient almost every day. Among the many, I will name the following, which I advise our apprentices to learn to tie: The square knot, the two half hitches or artificers' knot, the blackwall hitch, the bowline knot, the catspaw, and the sheepshank. A description of the above will be found in the "American Dictionary." In my experience as a mechanic I have found frequent use for the above, and have never regretted knowing how to make them—also, a knowledge of splicing ropes is useful.

While I was an apprentice I had to assist in putting in about 30 feet of lead pipe in a well. It was necessary to suspend it by a rope while the plumber made a joint. There were two men and another apprentice working on the job besides myself. I being the minor, had to take a back seat, "not knowing much." The rope was fastened by the plumber, and it was amusing to see that pipe slipping through the knot. After the other two had tried, with the same result, I ventured to say I thought I could tie a knot that would hold it, and as there seemed to be nothing else but to let me try, I was told to go ahead. I used the two half-hitches, or what is better known in England as a scaffold knot, which held the pipe and gave no further trouble. Sometimes we wish to fasten a chain around a post, pipe, or rod. We can do it in no better way than by adopting the same knot. It will bear a great strain, and still untie easily.

William Newton.

Friction of Journals.

Editor American Machinist:

In a recent issue of the American Machinist, commenting on a water-jacketed engine bearing, you say, "Where bearings are large enough for the load put upon them, and are kept in good condition, there will be no heating." As applied to the particular case mentioned, the statement may be correct, but I doubt very much if it is true in regard to all possible journals. The law of friction of lubricated journals has not been accurately proven by experiments under all possible conditions, but the result of experiments made by Beauchamp, Tower and others, shows that with a perfectly oiled journal, that is, with an oil bath, at a given speed, the friction was nearly constant for any load up to that which the lubricant would bear without being squeezed from the surfaces, but that the friction increased with an increase of velecity not in a direct, but in an accelerating ratio. Common experience with very high speed journals is in accord with the above experiments. If the bearing surfaces are of sufficient area to give a low enough pressure between the surfaces to allow of a free distribution of oil, and the oiling is by a bath, there is not much gained by additional bearing surface, and the total friction will be sensibly increased. The reason for this may be stated as follows: No surfaces can be rubbed together without friction, and wherever there is friction there will be heat.

The speed of a perfectly lubricated journal may be increased to an extent that the oil will be burned, and the bearing ruined, in spite of the fact that it was running in an oil bath. How can this be remedied? It is plain that some means of taking away the heat must be provided. There are several ways of doing this. A metal of greater conductivity may be used in the bearing; the bearing may be increased in extent; or a stream of cool oil or water might keep down the temperature.

The first plan would not be of much value, because there is not enough difference in the heat-conducting power of metals. The limit to the second plan is the space that can be spared on a given shaft for journals, and the further fact that it will sensibly increase the total friction, on account of the viscosity of lubricants. The use of a stream of water on a journal is too great a nuisance to be considered feasible as a regularly planned feature. In consideration of all the foregoing, I think that, with a journal bearing large enough so the pressure will allow of a perfect distribution of oil, with a circulating water jacket, and oiled by the circu-

lating system, that is, by flooding with a liberal stream of oil caught after flowing through the bearing, and cooled and used again, a very much higher speed could be successfully accomplished than would be possible with any system in use, without a water jacket.

Of course that means a considerable waste of heat, but that does not prove the existence of a bad condition of the journal, for I have known very high speed journals to run for days at temperature so high that a person could not hold the hand on them, and yet, upon being taken apart, they were found in perfect condition, with a surface like plate glass. BELL CRANK.

How Another Pulley was Bored.

Editor American Machinist:

This was a heavy one, 5 feet by 24 inch face and weighed 1,300. It was bored in a lathe, small and old-fashioned. When first built it would swing 36 inches. The front bearing of spindle was 3″x3″; face plate, 36 inches diameter. The bed was of pine and had been chopped out to swing 5 feet. The gap in bed was about 26″ wide, so that pieces could not be bolted to the face plate to increase its size. We had to bolt the pulley on by the arms. As the rim of pulley projected over the face plate, to fit gap we had a row of bolts around outside of face plate—butting against inside of pulley, to keep it from shifting.

We got it trued up at last and proceeded to bore it—then the music began. The boring was done by a compound rest fed by cam and ratchet movement. The hole was 4″ diameter by 12″ long, and the shortest bar we could use would be about 3 feet long from clamp to tool. As soon as the tool took hold the pulley lifted up about an inch, or until the weight and belt pressure broke the chip off. That stopped the show, and this is the way we got over the trouble. We got a 2½″ thick by 12″ wide and 12 feet long birch plank, bored a hole near one end and bolted a cross-piece two feet long on it. Then we hunted up a couple of board mill trucks about 6″ in diameter with a short shaft through them, mortised one into each end of cross-piece, placed a fulcrum under the plank about 2 feet back of cross-piece, and weighted down the other end, then turned the boring tool over to back of hole and started again. It bored just as smooth as though the piece did not weigh fifty pounds.

The pulley was turned by bolting an angle plate to the front of lathe, placing the compound rest on it and feeding in the usual manner, the pulley being put on a mandrel and running on the centers.

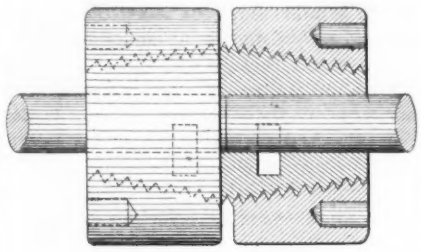
Another job on the same lathe was a lot of eight-foot rope sheaves with wood driven into rim for rope to run on.

They had to be bored for 3″ shaft and the wood turned. This job was done by swinging the head-stock around, so that the face plate overhung the end of the lathe. An old key-seating machine happened to be just the right height to bring the compound rest to the center when bolted on top of it, which in turn was bolted to the floor. A good job, and not a very slow one, was made.

These two jobs are samples of fifty I could mention done in that old shop. No job that could be got was refused on account of its size, and the way the difficulties were overcome and the job that was made is something to remember and feel proud of.

I may as well say that I bored the pulley when in my second year's apprenticeship.

The idea of the rollers under the pulley was suggested by something I had read in the AMERICAN MACHINIST about boring a hydraulic cylinder, using rolls under the edge of face plate. NED.



A Compression Coupling.

Editor American Machinist:

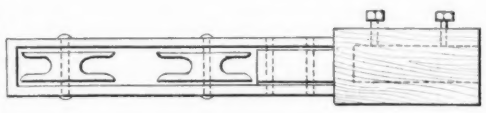
I enclose a sketch of a compression coupling which seems to possess some advantages over some couplings now in use.

In designing this coupling I have kept in view the fact that many couplings have a tendency to spring the shaft on being made fast—a fault which seems to be eliminated in this design.

The inner sleeve is bored to fit the shaft, is large in the middle on the outside, and tapered to the ends and threaded and split longitudinally. One of the pieces may be doweled to the shafts for greater security.

The outer or binding collars are threaded to fit the taper of the sleeve, and provided with spanner holes as shown.

BENJ. F. WILSON.



A Belt Shifter Kink.

Editor American Machinist:

So far as to relieve the sufferings incident to a machine shop, I think that the kinks are a good thing if they are taken advantage of by the suffering; there are lots of them, but it is so hard to make a machinist think that he has done anything extra, that they will never all come out.

One thing that causes much trouble is the shipper on a planer; it will wear sharp on the edges, and then away goes the belt; and who has not had a belt cut in two, or if not that, had a piece ¼″ by from 1 foot to 3 or 4 feet in length cut out at just the time that the planer was most needed?

I put the device sketched above on one planer about six months ago, since which time we have had no trouble with the belt. I have also put it on several planers since. It is made of ¼″x1¼″ iron, with two brass pulleys set ¼″ wider than belt, the pulleys having deep flanges, and running on ¾″ pins.

W. A. ROBERTSON.

The Ridgeway Balanced Steam Hydraulic Crane.

Our illustration on this page shows a type of crane which has been introduced into a number of foundries and other iron-working establishments, and on account of the simplicity of its mechanism and its small liability of being injuriously affected by the sharp dust, which is usually one of the features of such places as well as other points, which we shall specify, it has given good satisfaction.

While this crane is a genuine hydraulic crane, yet no pumps or accumulator are required, and no water is consumed. With a height of building of sixteen feet, a lift of 8 feet can be obtained, and with a height of 21 feet, a lift of 12 feet is obtainable.

The cut was made from a crane of 5 tons capacity, recently erected in the works of the Diamond State Iron Company, at Wilmington, Del., and similar cranes have been erected in a number of the leading foundries.

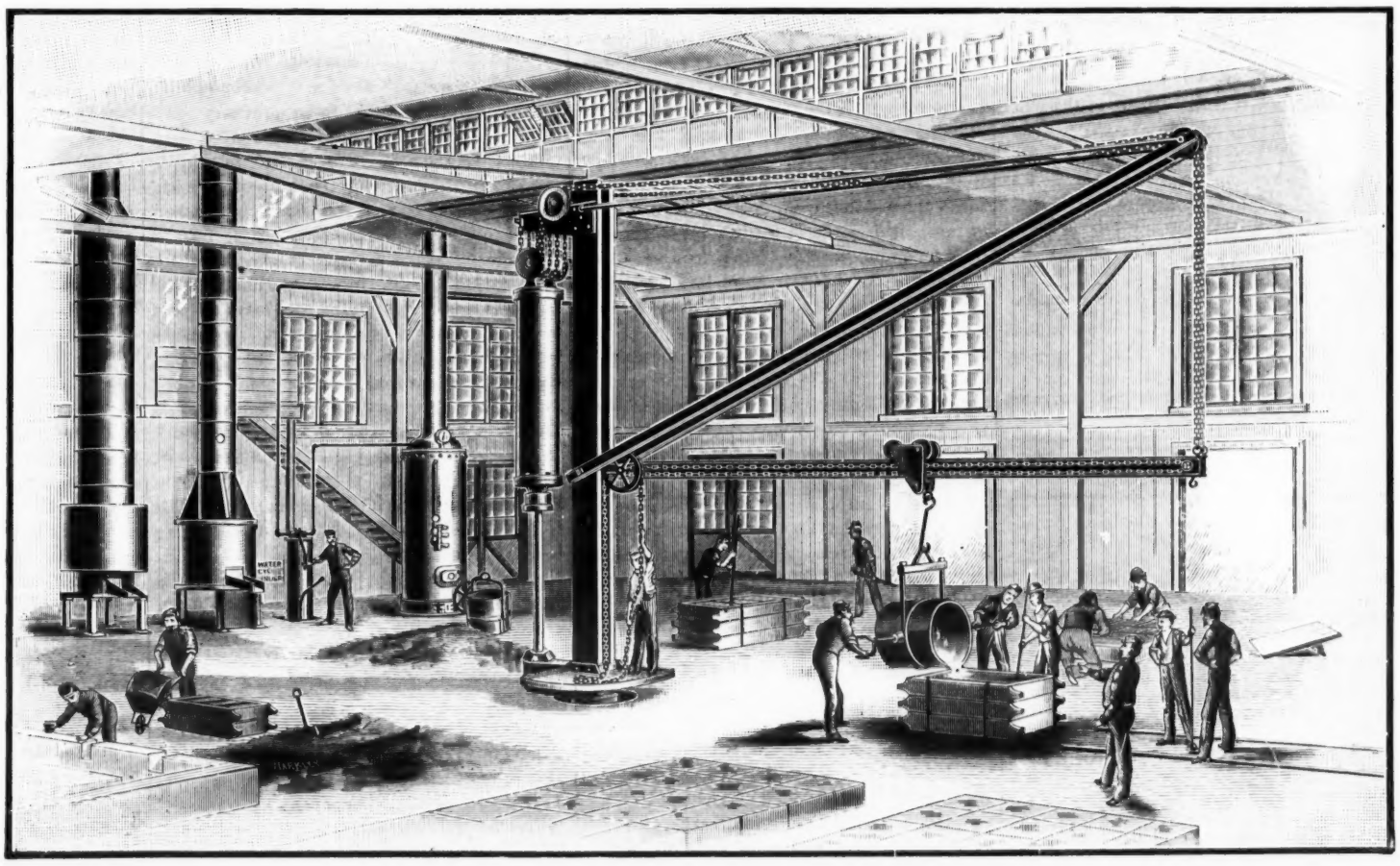
The crane is balanced, and the pressure that operates it is obtained from the ordinary steam supply of the shop, the crane being designed to suit the steam pressure carried.

In the ground near the cupola will be noticed a cylinder. On top of this cylinder is placed an ordinary D slide valve from which a pipe extends to a special boiler or to the ordinary boiler of the works. A second pipe, which is the exhaust, passes outside the building. From the bottom of this cylinder a pipe extends to the bed-plate of the crane, and through this bed-plate and bottom gudgeon and a packing-box, it connects with the piston rod of the cylinder on the crane. This piston rod is hollow, with a bore same as that of the pipe.

The crane itself is a very simple structure with chain wheels upon the mast, and at the end of the inclined brace. From the chains passing over these wheels—two at each end, short and very heavy—is hung the jib upon which travels a free trolley. The other ends of these chains pass around chain wheels upon the larger cylinder at the back of the crane and are fastened to the brackets upon the mast. As the pressure used is comparatively low, rarely exceeding 100 pounds and generally 70 to 80 pounds, in order to obtain the desired lifting capacity, the cylinder upon the crane is large and heavy. But its weight is needed and is used to balance the weight of the jib, this balanced condition not only serving to make the crane swing very easily, but also relieving the roof framing of all unnecessary strain.

The crane is operated as follows: The cylinder in the ground is filled with water to within a foot of the top, this space being filled with air. A load being attached to the trolley, steam is admitted to the water cylinder, but is prevented from coming in contact with the water and condensing by the body of air. The water is forced by the steam pressure to the crane, where it passes up through the hollow piston rod into the lifting cylinder, and presses the latter down the rod. As the lifting cylinder descends the jib carrying the trolley rises, in the particular crane shown two feet for each foot of movement of the cylinder. The load is moved on the jib either by pushing directly upon it, or it can be racked by the hand chain. To lower the load, the steam is exhausted, and the water flows back to the water cylinder by gravity and the jib descends. The same water is used over and over. It will, of course, be evident that the speed at which this crane works with a given steam pressure will depend upon the size of the passage between the crane and water cylinder. A valve is consequently placed in the pipe connecting the water cylinder and crane, and the opening of this valve controls the speed. Its handle is near that of the operating valve. If now a cope or pattern is being started, or if beginning to pour, full steam is thrown on the water cylinder, but the valve is opened so slightly that a small quantity of water passes through, the crane moves very steadily, yet with its full power, and, when required, the valve is thrown wide open, and the crane, without shock, jar or noise, moves at full speed. By closing this valve the load can be held indefinitely, and steam shut off.

The crane is so simple that almost any one can operate it, and it cannot run away, since it moves at the same speed whether loaded or unloaded. The cylinder at the mast, of course, needs no guides, as its natural tendency is to hang perpendicularly, and the pressure only tends to hold it in this position more firmly. The Franklin Institute has awarded to this crane the John Scott medal and premium. It is the invention of Mr. H. Ridgeway, C. E., and is manufactured by Ridgeway & Son, Coatesville, Pa.



RIDGEWAY BALANCED STEAM HYDRAULIC CRANE.

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Teaching Trades in Reformatories.

Under the system which is followed in this country at present in the matter of learning trades, a young man who acquires a trade must usually do it by the practice of self-denial, either directly by himself or by his friends for him; that is to say, he must work for a number of years for less wages than he could earn in other pursuits during the same time; wages which in most, if not all cases, are insufficient to support him. He practices this self-denial in order that he may reap the reward of so doing, which reward comes in the form of wages, and opportunities above those of the common laborer. The skill thus acquired is usually considered to be the young man's capital, and the increased wages received by reason of its possession, his legitimate return upon that capital. So far as we can see, it conforms strictly to the political economists' definition of capital, and, we believe, is correctly regarded as such.

So long as a young man is honest, and refrains from doing anything for which society considers it necessary for its own good to punish him, this capital, if it is acquired by him, must be acquired by his own sacrifice, without any assistance whatever from the State. Whether the State should so assist him or not is a question which we need not discuss at present. Many believe it should do so, while many others believe it should not. That the majority in this country believe it should not seems to be proven by the fact that it does not, but leaves every honest and law-abiding young man to acquire the capital with which to fight the battle of life in his own way, and by his own efforts, whether this capital be in the form of goods, money, or acquired skill. And those who, for any reason whatever, fail to acquire capital of any kind, are still expected to be law-abiding citizens, and the State stands ready to punish them if they are not.

The State of New Hampshire, so far as we are aware, considers itself under no obligation to furnish its honest young men with trades by which they may "become useful members of society," but expects them to get trades or other forms of capital as best they may, and to be "useful members of society," whether they succeed in getting it or not. But at the Reformatory at Concord it is teaching various trades to the young men who, for various more or less serious offenses against society, have been confined there, thus showing practically that the commission of an offense against society is considered to place society under some obligations to him who has committed that offense, obligations which it would not have incurred had he been orderly and law-abiding.

The first impulse of a kindly disposed heart is to say that this is a good thing to do, because it is reasonable to suppose that many young men who would otherwise leave this institution to resume and go further in a career of crime are saved to lives of usefulness.

It seems to us, however, that there are other things to be considered in connection with the matter. In the first place, is this not tantamount to a declaration by the State that honest and useful lives are not possible without trades? We all know that a vast amount of useful work is to be done, which must be done by men who have no trades. The mere laborers in this country who perform unskilled, yet nevertheless useful work, far outnumber the mechanics. Are not these men expected to be useful and law-abiding citizens, and do not all others who are without trades have an equal chance with them, so far as being honest and law-abiding is concerned?

We find some of the newspapers and technical journals severely condemning the action of an organization of Boston plumbers in objecting to this teaching of the plumber's trade in the Concord Reformatory, treating the matter as though there were only one side to the question, whereas, as a matter of fact, this, like most other questions, has more than one side. Suppose that the young men confined in reformatories were taught some of the professions instead of mechanical trades. Would the principle be any different? And might we not expect in such a case a very vigorous protest from those who had at their own expense or by their own effort acquired a profession in the regular way? Would they not have the right to protest against the State educating men to compete with them in their profession, not as a reward for special merit or fitness, but as a consequence of criminal offenses against society? And if they did so protest, would we find these papers condemning them for protesting? We think not. And yet, so far as we can see, the principle involved is precisely the same where trades are taught, and, when it comes to a matter of rights, we insist upon it that the men who wear overalls or mechanics' aprons should have precisely the same rights and the same protection that other citizens have. Nothing less than this is either right or politic.

We think, too, that such teaching of trades has a tendency to degrade those trades in the eyes of the public, and that the State has not the right to select certain callings from among the others, and thus degrade them, and if the right to do so be granted, that it is by no means good policy for it to do so.

What is the best thing to do with such young men as it becomes necessary to confine in reformatories is a serious question to decide. They are usually not hardened or confirmed criminals, and have not forfeited their right to live. All should be done for them that can be done with regard to the rights of others, and we hope that a satisfactory solution of the problem will be eventually arrived at. But those papers which so severely condemn mechanics for calling attention to what they believe to be their side of the question, are pursuing a course which is grossly unfair, and which will effectually prevent them from ever having much if any real influence in the right settlement of the question.

There is an undefined and prevalent idea that railroad companies in this country exercise an undue influence in legislative matters. To some extent this is true, but not to the extent they are popularly credited with. The railroad interests are large, and naturally enough the influence exerted by the companies is especially noticeable for this reason. But in proportion to the interests involved, it is doubtful if any more legislative influence is exercised in railroad matters than in other affairs. Railroad corporations sometimes fail to obey restrictive laws, but so do other corporations. Sometimes railroad companies work to the end of getting laws passed that work more particularly in their interests than in the interests of the citizens generally. This is the case with every company representing a large aggregation of capital. With our present law-making system in force, there hardly seems to be any other plan than for great corporations to work out part of their salvation through legislative bodies. Men in all conditions of life fight with weapons at hand, and it does not appear to change a man's nature a bit because of his having the greatness of a railroad directorship thrust upon him.

A recent account from Norwich, Connecticut, of a dozen people, more or less, being prostrated in a church from the effects of coal gas is creditable enough as a matter of news, but sadly out as to opinion. It is a fact that ought to be generally known, that men can work in a shop or office and never notice the almost killing properties of the air that makes itself instantly manifest to one coming in from the outside. There are plenty of machine shops and offices in the country in which men work week by week, where the conditions are such that intelligent work is nearly impossible, or, at least, is in the nature of pulling down vital force in a way that is wonderfully wasteful. And these conditions almost invariably exist through ignorance which comes from constant association. If some bright inventor could give us a tell-tale machine, something like a steam gauge, that would all the time point out to us the exact condition of the air we had to breathe, he would do a good thing.

An apprentice sends us a clipping from the paper published in his town, giving an account of the supposed performance of a Pennsylvania man, who is said to have put a cartridge between his teeth, and, accidentally biting hard upon it, it exploded, and the bullet buried itself in a wall opposite, while the man was uninjured. Our apprentice friend remarks that the man must have been very peculiarly constructed to do such a thing without injury, and his conclusion is, from seeing this and similar things in the papers, that some of the editors don't know very much. This is a very natural conclusion to arrive at, we must say, when the frequency of such items in the news papers is considered; but it is probable that their insertion results more from carelessness than pure ignorance. Of course, any one who stopped to think, and who, at the same time, knew anything of the laws of physics, would know that a cartridge could not be fired from the mouth in this way without serious injury to the mouth. The worst feature of the publication of such items is that they are calculated to mislead those not well grounded in physics, and may, in some cases, lead to the trying of foolish and dangerous experiments.

A week or two since we published a communication from a correspondent relating especially to the subject of patents, and particularly to that part of the business known as the patent sales agencies. Since publishing this letter we have had a large number of communications, many of which are really good. There are copies of letters from patent sharks; also from those who, apparently, mean to do an honest business.

A good many correspondents lay much stress upon the fact that a charge of 25 cents is made for a copy of a patent. We pay 10 cents for such a copy, buying fifty coupons, good for any copy from the Patent Office, in order to do this. But if we were to write to some attorney to go to all the trouble for us, we should think that 15 cents was a small enough remuneration.

There are dishonest men in the business of working up claims for patents. On the other hand, there are honest men in the same business. One must judge in this as in any other matter.

The Locomotive reports 19 explosions of boilers during December, '90. Of these, three were locomotive boilers and *seven* saw-mill boilers. No other single industry has more than one explosion charged to it. The proportion of locomotive boilers is, we believe, unusually large, but it will be noticed that the deadly saw-mill boiler fully maintains its reputation.

Literary Notes.

VALVE GEARS. By H. W. Spangler, P. A. Engr. U. S. Navy; Whitney Professor of Mechanical Engineering in the University of Pennsylvania. Analysis by the Zeuner Diagram.

This work treats on the designing of the different types of valve gear, and the analysis of the same by the Zeuner diagram. It includes the designing and setting of the plain slide valve, gives modifications of the plain slide valve, such as the double-ported valves, the Allen valve and piston valve. The action of Stephenson link, and the manner of suspending it are explained, and several chapters are devoted to Gooch motion, Allen and Fink motion, shaft regulations, radial gears, including Hackworth, Marshall, Angstrom, and the Joy valve gear. The Buckeye valve, and the Meyer valve are illustrated, and their action explained and analyzed, and a short chapter is devoted to the analyses of the valve motions by the Bilgram and Reuleaux diagrams. All the subjects are treated in a concise manner, and their arrangement is such as to adapt the book to the use in class-rooms. The book is published by John Wiley & Sons, 53 East Tenth street, New York. Price, $2.50.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(134) J. D., St. Catharines, Canada, writes: Please inform me where I can find instructions in making a galvanic battery. *A.*—See any elementary treatise on physics.

(135) X. Y., ———, writes: Please let me know the composition used to galvanize castings, and how applied. *A.*—See answer to Question 445, in our issue of December 5, 1889.

(136) G. H. D., Barrowsville, Mass., asks: How much grate surface will I require for burning sawdust and shavings for a boiler 5 feet diameter, 16 feet long, with 92 tubes, 3 inches diameter? *A.*—Width of grate, 5 feet 9 inches; length, 8 feet.

(137) M. E. T., Detroit, Mich., asks: Is there a good book published on gold, nickel and silver electro-plating? If so, please give name and address. *A.*—Write to the Gorham Manufacturing Company, silversmiths, Providence., R. I., for one of their books on electro-plating.

(138) T. McB., Philadelphia, Pa., asks: What would be the horse-power of an engine with two cylinders 8x8 inches, 150 pounds steam pressure, revolutions per minute, 500? There being a dispute about the matter we would be pleased to have you answer. *A.*—We should rate the engine at 152 indicated horse-power.

(139) A. W., New York, asks: Why are the shifting links of American locomotives curved? What effect, if any, would it have on the valves if the links were made straight instead of curved? *A.*—A straight link will give an unequal lead when the link is hooked up. For fast speeds the links are always hooked up, and since it is important to have an equal lead for any position of the link, it is curved.

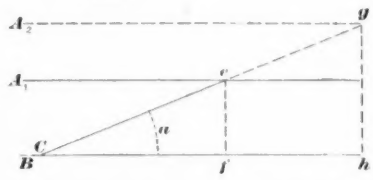
(140) W. D., Rhinelander, Wis., writes: Please publish the correct dimensions for a twelve-foot sectional fly wheel to weigh 7 tons, and to run at 100 revolutions per minute. *A.*—The dimensions of the wheel are to some extent arbitrary, and will depend considerably on the judgment of the designer. We should make the rim 10 inches deep, 8 inches wide. Eight arms, the cross-section of each arm near the hub should be about 50 square inches. You did not give size of shaft, we therefore cannot compute the weight of hub. If necessary, a little can be added or taken off the rim to make the whole weight equal to 7 tons. The above dimensions are for tons of 2,000 pounds.

(141) G. J. T., Liverpool, Pa., asks: What mixtures of iron should we use for moldboards and shares? *A.*—Car wheel scrap will be suitable iron for moldboards and shares, if care is taken to choose such a grade as will leave all the parts not in immediate contact with the chill comparatively soft and gray. Iron for castings having chilled parts should be strong and close, having the minimum amount of shrinkage; the degree of hardness must be regulated according to thickness of casting required. 2. How heavy or thick should the chills for the moldboard be, also for the shares? *A.*—From one to three inches in this case. The depth of chilled surface will be in proportion to the thickness of the chill mold used. 3. Should the iron be poured very hot, or should it be poured at as low a temperature as it will flow to fill the impressions? *A.*—Good fluid iron should be used, but it is not desirable to pour such molds too hot. 4. What should the faces of the chills be covered with? *A.*—A mixture of coal oil and silver-lead may be rubbed well into the surface in this case; and should the pouring gate be sufficiently remote from the chill, a little oil would be all that would be required. See article, "Chilled Castings," by S. Bolland, in our issue of February 21, 1889.

(142) B. B., Petoskey, Mich., writes: Our cupola burns out in about eight heats; that is, when we have cast eight times we are obliged to re-line with fire brick. Our fan is 24 inches diameter with four vanes 8x8 inches, and set almost straight out from the center, with discharge pipe from fan of 8 inches diameter, which runs to back of cupola, and then the blast is carried into the cupola by two tuyeres set opposite each other, and 15 inches above bottom of plate. The cupola is made straight on inside, and is 22 inches diameter in the clear when newly lined. Now we know of other cupolas which run six or eight months, and still longer, without re-lining. We have good fire brick and clay. It takes from 1 to 1½ hours to melt from 20 to 25 hundred pounds of iron. Do we need more blast and more tuyeres? *A.*—We have referred this matter to Mr. S. Bolland, who replies as follows: There is not sufficient data given to enable me to answer the questions direct; I therefore give what I believe to be the correct particulars for working a 22-inch cupola, so far as blast, blast pipes and tuyeres are concerned. In the first place, from 1,200 to 1,800 pounds per hour is very favorable melting in a 22-inch cupola; more frequently the former is obtained, so it seems that the cupola in question is overworked, with the result as stated. For such a cupola, 324 cubic feet of air is required per minute, requiring a No. 1 Sturtevant pressure blower or its equivalent. Blast pipes should be 6½ inches diameter for 100 feet of travel, and 8½ inches for 300 feet. The number of tuyeres and size should be two of 5 inches diameter, or three of 3½ inches diameter. Blast pressure should be from 4 to 5 ounces, and height of charging door about 9 feet. Such a cupola, if carefully worked, should melt from 3 to 4 tons.

(143) W. O. J., Gladstone, Minn., writes: Please give me a rule for solving the following problem: Given two parallel lines 5 feet apart, and a third line drawn from one parallel line to the other, making an angle of 22° 30′ with the parallel lines, what will be the length of the third line? *A.*—From a table of natural sines take out the sine of 22° 30′, it is .3826; divide the distance between the parallel lines by this sine, the quotient will be the length of the third line, thus:

$$\frac{5 \text{ feet}}{.3826} = 13.068 \text{ feet.}$$



If the distance between the parallel lines is taken in inches, we then have

$$\frac{60}{.3826} = 156.82 \text{ inches}$$

for the length of the third line. The principle upon which this rule is based will readily be seen by considering the fundamental relations which some of the trigonometrical functions sustain to each other. Let A and B be the parallel lines, C a line drawn between them, making an angle a with B; the line $e f$ perpendicular to B will then represent the sine of the angle a. If, now, the angle a contains 22° 30′, and the distance between the parallel lines A and B is such that the length of C will be just 1 foot, then the perpendicular $e f$ will be .3826 of a foot. If, now, the distance between A and B is increased, as indicated by the dotted line A_2, and $C e$ be lengthened to $C g$ without changing the angle a, then $C g$ will be just as much longer than $C e$ as $g h$ is longer than $e f$. Hence we have

$$e f : g h :: C e : C g.$$

When the angle $a = 22° 30′$, and $g h = 5$ feet, we have

$$.3826 : 5 :: 1 : C g,$$

from which we get

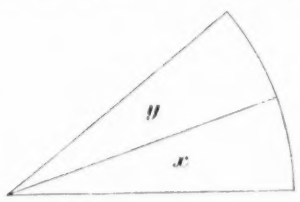
$$\frac{5}{.3826} = C g = 13.068 \text{ feet.}$$

(144) F. L., Baltimore, Md., writes: I understand that in some tugboats the link is made to hook up, while in some other small marine engines it is made for reversing only. Now, what is the difference between these links? *A.*—When the link is used for reversing only, the saddle pin or the pin from which the link is suspended is usually placed on the center line of the link. When the link is to be used for changing the cut-off, or, in other words, when it is to be hooked up, it is advisable to place the saddle pin so that the steam will be cut off at equal distances from the ends of the forward and backward strokes; in other respects the links are alike; in fact, some makers place the saddle pin on the center line of link, whether it is used for reversing or for changing the cut-off. 2. In computing the horse-power of an engine, how can we find the steam pressure on the piston without using an indicator? *A.*—Without an indicator you can only make an approximation of the steam pressure on the piston, and the closeness of the approximation will depend considerably on your experience in such matters. The basis to work from is the steam pressure indicated by the steam gauge, but this may be greatly reduced in the steam chest, the reduction depending on the length of steam pipe between steam chest and boiler, and the manner in which the steam pipe is covered. If the engine is placed close to the boiler, and the steam pipe is well covered so as to prevent condensation, we may consider the initial steam pressure to be equal to the boiler pressure. The next step will be to find the mean pressure on the piston. To do so, find the ratio of expansion by dividing the length of the stroke by the distance from the beginning of the stroke to the point of cut-off; find the hyperbolic logarithm of the ratio of expansion by referring to a table of such logarithms; add 1, and multiply this sum by the steam pressure, and divide the product by the ratio of expansion; the quotient will be the mean pressure. To illustrate: Suppose it is required to find the mean pressure of steam of 100 pounds absolute pressure, cut off at 6 inches in the cylinder, the stroke of the piston of which is 24 inches: $24 \div 6 = 4 =$ ratio of expansion. The hyperbolic logarithm of 4 is 1.386; adding one we have 2.386. Multiplying this by the steam pressure we have $2.386 \times 100 = 238.6$. Dividing this by the ratio of expansion we have $238.6 \div 4 = 59.65$, which is the mean pressure in pounds per square inch of piston. Subtracting from this the back pressure we obtain the mean effective pressure per square inch of piston which is used for computing the horse-power of an engine. For ordinary estimates of the horse-power of engines we take one half of the boiler pressure for the mean effective pressure.

(145) M. M., ———, asks: Given an angle and the radius, how do you find the sine of the angle without taking it out of the table? Or, in other words, how is the table of sines made? *A.*—Finding the sine of an angle is equivalent to making a table, since we first have to find the sine of a small angle, and then work up by minutes and degrees. This, of course, involves a great amount of labor, and therefore the sines are never found without a table. The sines in a table are computed in the following way: It is evident that an arc is longer than its sine, but that this disparity diminishes as the arc grows less. Thus, in a circle whose radius is 1 inch, the length of the sine of an arc 1° would not differ appreciably from the arc. Much less should we be able to distinguish between the sine of 1′ and the arc. Now, when the radius is 1 the semi-circumference will be equal to 3.141592, and also $=180°$, or $180 \times 60 = 10{,}800'$. From this we get the length of an arc of $1' = \frac{3.141592}{10800} = 0.0002908882$ approximately. Assuming this as the sine of 1′ we obtain the cosine thus, cos. $1' = \sqrt{1 - \text{sin.}^2 1} =$

$$\sqrt{(1 + \text{sin. } 1') \times (1 - \text{sin. } 1')} =$$
$$\sqrt{1.000290882 \times .9997091118} = 0.9999999577.$$

Having thus obtained sufficiently accurate values of sin. 1′ and cos. 1′, we can continue the operation as follows: Let x and y repre-



sent any two angles. It can be proved that sin. $(x + y)$ + sin. $(x - y) = 2$ sin. x cos. y, and cos. $(x + y)$ + cos. $(x - y) = 2$ cos. x cos. y. Hence we have:

sin. $(x + y) = 2$ sin. x cos. $y -$ sin. $(x - y)$
cos. $(x + y) = 2$ cos. x cos. $y -$ cos. $(x - y)$.

Now letting y remain constantly equal to 1′, and letting x take successively the values 1′, 2′, 3′, etc., we have:

For $x = 1'$:
- sin. $2' = 2$ cos. $1'$ sin. $1' -$ sin. $0' = 0.0005817764$
- cos. $2' = 2$ cos. $1'$ cos. $1' -$ cos. $0' = 0.9999998308$

For $x = 2'$:
- sin. $3' = 2$ cos. $1'$ sin. $2' -$ sin. $1' = 0.0008726646$
- cos. $3' = 2$ cos. $1'$ cos. $2' -$ cos. $1' = 0.9999996193$

For $x = 3'$:
- sin. $4' = 2$ cos. $1'$ sin. $3' -$ sin. $2' = 0.0011635526$
- cos. $4' = 2$ cos. $1'$ cos. $3' -$ cos. $2' = 0.9999993232$

There is no difficulty in computing these values, but the labor is very great. Of course 60 operations are required for every degree.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

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"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.

MANUFACTURES.

Florence, Ala., is to have a 10-ton ice factory.

The Atlanta (Ga.) Car Company may enlarge its car works.

New boiler works are to be established at Chattanooga, Tenn.

J. H. Krause will, it is reported, start a brass and iron foundry at Tampa, Fla.

The South Anniston (Ala.) Nail Works, recently burned, will be rebuilt at once.

Pettefer Bros. will put new machinery in their planing-mill at Little Rock, Ark.

At York, Pa., $30,000 has been subscribed toward building new machine shops at that place.

The National Wire and Iron Company, Cleveland, has been incorporated, with a capital of $10,000.

The Greenwood (S. C.) Compress Company has been incorporated, with a capital stock of $30,000.

The Jellico (Tenn.) Ice and Electric Light Company has been incorporated, to erect an ice factory.

W. C. Codd, of Baltimore, Md., is negotiating for the establishment of boiler works in Roanoke, Va.

A $150,000 cotton-mill is reported as to be erected at Hillsboro, N. C. C. M. Parks can give information.

The Progress Manufacturing Company, Meridian, Miss., will, it is reported, enlarge its machine works.

The Norfolk & Western Railroad Company will soon erect additional machine shops at Shenandoah, Va.

A committee of citizens has been chosen to organize a co.ton-mill company at Hickory Grove, S. C. J. N. McGill can give information.

New machinery is being added to E. C. Wehrfritz's iron foundry and machine shops at Little Rock, Ark. The buildings will also be enlarged.

The Golden Foundry and Machine Works, at Columbus, Ga., are about ready to begin work, and are well equipped with modern machinery.

The Board of Trade has accepted the Omaha, Kansas City & Galveston Railway Co.'s proposition to establish machine shops at Denison, Tex.

J. H. Ferguson, of Bridgeton, N. J., is reported as having signed contract for the removal of his boiler and machine works to Basic City, Va.

It is stated that the Chesapeake & Ohio Railroad Company will establish, at Russell, Ky., a machine shop and iron foundry that will cost $250,000.

The Anderson (S. C.) Iron Foundry and Machine shop will be enlarged, and the making of sorghum-mills will be added. R. F. Divver is the owner.

The Southover Land and Improvement Company will, it is reported, issue $200,000 of stock for the purpose of building a cotton-mill at Savannah, Ga.

It is reported that the Missouri, Kansas & Texas Railroad Co. (office, Parsons, Kan.) will remove its Taylor and Alvarado machine shops to Waco, Tex.

The stockholders of the Oswego Foundry and Malleable Works, at Oswego, N. Y., have decided to increase the capital stock and put in a malleable plant.

N. S. Keay, of Philadelphia, Pa., is prospecting at Chattanooga, Tenn., for the purpose of establishing a plant for manufacturing steel by the Bates process.

Maj. McGregor, W. D. Fullerton and Marcus Hitch have incorporated the Columbia Car Coupler Company, at Chicago, with a capital stock of $300,000.

The Long Island Cotton-mills Company will put an electric light plant in its mill at Monbo, N. C., as reported recently; will also put in additional machinery.

The Texas & Pacific Railway Co. (office Dallas) is reported as putting new machinery in, and increasing the capacity of its Fort Worth (Tex.) machine shops.

The New York Sewing Machine and Manufacturing Company has been organized, and signed contract to erect a sewing machine factory in East Richmond, Va.

It is stated that Howard & Steers will erect at New Castle, Va., a plant for the manufacture of steel by the Adams direct process; capacity to be 100 tons per day.

The Low Moor Mining and Development Company is corresponding with Northern parties relative to establishing an iron foundry and machine shop in Low Moor, Va.

The Taylor Electric Signal Company, of Chicago, has been incorporated with a capital stock of $500,000, to manufacture machinery for steam and electric street railways.

The Phœnix Iron Works, of Cleveland, Ohio, are reported to be in negotiation with parties at Roanoke, Va., looking to the establishment of iron works in the latter place.

At Talladega, Ala., J. W. McConnel, W. R. Hall, Sydney Bowers and others have incorporated the Alabama Iron, Land and Furnace Company, to erect a 125-ton iron furnace, etc.

W. G. Cooper, J. H. Baker, C. A. Drayton and others have incorporated the Savannah Crystal Ice Company at Savannah, Ga., to manufacture ice. The capital stock is $35,000.

The Morris Machine Works, Baldwinsville, N. Y., have issued a new circular containing information about the Heald & Sisco centrifugal pumps, which are manufactured by them.

The Norfolk & Western Railroad Co. (office Roanoke) has under consideration the erection of the machine shops and roundhouse at Shenandoah, Va.; estimated cost $60,000.

The Thompson Manufacturing Company, of Lancaster, N. H., founders and machinists, have let the contract to rebuild their shops, and as soon as practicable work will be begun.

The O. L. Packard Machinery Company, of Milwaukee, Wis., has filed articles of incorporation, signed by W. S. Williams, Fred. H. Kappe, Fred. Hildibrand, and James Morrison.

Messrs. L. J. Berger, A. B. Robinson and G. A. Richards have incorporated the American Bridge Works, of Chicago, Ill., for the manufacture of bridges. The capital stock is placed at $100,000.

The Wenstrom Consolidated Dynamo and Motor Company, of Baltimore, Md., contemplate issuing $25,000 in bonds for the purpose of establishing a plant for the manufacture of dynamos and motors.

The Drummond-McCall Pipe Foundry Company is being incorporated at Montreal, Can., with a capital stock of $50,000, to establish works and manufacture cast-iron gas, water and other pipes, etc.

Of the $700,000 capital of the cotton-mill to be erected at Columbia, S. C., $300,000 has been subscribed at the North, and it is believed that the balanced will be readily taken in Columbia and vicinity.

A. A. Arthur and others are organizing an industrial development company, to have a capital stock of $2,000,000. Negotiations are now in progress for the location of eleven new industries at Middleborough, Ky.

The Atlas Iron Construction Company has filed articles of incorporation at Albany, N. Y. The company is organized with a capital stock of $50,000, to manufacture iron and metal work in New York and New Jersey.

The plans for the new shops of the Louisville, Evansville and St. Louis road, at Princeton, Ind., have been completed, and President Mackey has given orders that their construction be commenced early next month.

The people of Renfro, Ala., are expecting the establishment in their town of rolling-mills, pipe-mill and other industries by a newly formed corporation created for the purpose of aiding in the development of the town.

The United States Bit and Tool Company, of Chicago, Ill., has been incorporated, to manufacture, repair and sell patented articles; capital stock, $50,000; incorporators, Elwood C. Phillips, C. M. Greene and Ebenezer Wakeley.

Articles of incorporation have been filed by the Northwestern Engineering and Machinery Company, of St. Paul, Minn. The capital stock is $50,000, and the incorporators are Charles A. Daigh, W. G. Strickland and J. M. Badger.

A stock company will, it is reported, be organized at Waxahachie, Tex., to erect a cotton compress, and also operate a cotton-seed oil-mill in connection with same; the cost is to be $75,000. E. A. Du Bose can give information.

The Stowall Iron Company, of Duluth, Minn., has filed articles of incorporation with a capital stock of $1,000,000. The officers are: President, W. H. Stowall; vice-president, T. H. Pressnell; secretary, B. E. Baker; treasurer, A. C. Jamison.

The Canonsburg Iron and Steel Company, of Canonsburg, Pa., has decided to enlarge its capacity. The firm manufactures sheet iron and steel for stamping purposes and galvanizing. The present capacity is about 4,000 tons per year.

The new structure to be erected by the Benedict & Burnham Manufacturing Company, at Watertown, Conn., will be of brick, 93x130 feet on the ground, with two stories, the first to be used as a rolling-mill, and the second as a wire-mill.

The A. Plammondon Manufacturing Company, of Chicago, will erect, early in the spring, a factory for its own use. The structure will be 385x200 feet, two stories high, and will cost $150,000. Pulleys, shafting, gearing, etc., will be manufactured.

There is water-works agitation in Hickory, N. C.; Steelton, Pa.; Portsmouth, O.; Blacksburg, S. C.; Olney, Ill.; Nelsonville, O.; Dundee, Ill.; Pueblo, Colo; Toronto, Ont.; Brunswick, Md.; Pelham Manor, N. Y.; Cheyenne, Wyo.; Rochester, N. Y.

The glass factory of the Lippincott Lamp Chimney Company at Findlay, Ohio, was recently destroyed by fire, together with a large stock of manufactured goods in the warerooms and six carloads of goods on a side track. The loss is estimated at $40,000.

The Martinsburg Mining, Manufacturing and Improvement Company has closed contract with the Common Sense Engine Company, of Springfield, Ohio, to build branch boiler and engine works in Martinsburg, W. Va. Expect to be ready for operation by July 1st.

The Day Railway Construction Company, of Chicago, has been incorporated, with an authorized capital stock of $10,000,000 to construct surface and elevated roads, rolling stock, motive power and appliances; incorporators, St. John V. Day, Edwin F. Getchell, and Willard T. Block.

A corporation to be known as the Staple Fastening Machine Company, capital stock $100,000, has been organized at Saco, Me., for the purpose of doing a general machinery business. The officers are: President, William S. Hamm, of Newton, Mass.; treasurer, J. Sidney Snow, of Boston, Mass.

Curtis & Curtis, of Bridgeport, Conn., manufacturers of pipe-cutting and threading machinery, have received their third order for their pipe-threading machinery to be placed in the Norfolk navy yard. They also have on hand a number of large foreign orders, which as yet they have been unable to fill.

Mr. H. B. Cragin, agent of Washburn & Moen, the barbed wire manufacturers, of Massachusetts, announces officially that the company has purchased between 800 and 1,000 acres of land adjoining the town of Waukegan, Ill., a few miles north of Chicago, and will begin work on its manufacturing plant there this spring.

The announcement is made that a large plant will be established in Glasgow, Va., employing 500 men for the manufacture of passenger, baggage, postal, refrigerator, and freight cars, to be constructed entirely of steel, the only wood entering into their get-up being a few strips in the steel frame to assist in fastening the outer covering.

It is reported that the Brown Segmental Tube Wire Cannon Company have secured an option on five acres of land, near Greensburgh, Pa., about 30 miles from Pittsburgh, for the erection of works to manufacture wire-wound cannon, which are said to be practically indestructible. If arrangements can be made, a large plant will be erected.

Arrangements are being made to increase the working force and the capacity of the Gulf, Colorado & Santa Fe repair shops at Gainesville, Texas, it being the intention of the company to move all the heavy repair work to the Gainesville shops in the near future, especially that portion of it that has been done in the Cleburne shops heretofore.

The American Tube and Iron Company have completed plans for the erection of large additions to their works at Middletown, Pa. A lap-mill 60x341 feet has been finished; also a butt-mill 168x180 feet, and preparations are being made for the erection of another butt-mill, to adjoin the one just built, the size of which will be 84x120 feet.

The South Florida Foundry and Machine Company, Orlando, Fla., has been reorganized as the South Florida Foundry and Machine Works, with J. S. Giles, president; C. E. Johnson, vice-president, and E. F. Sperry, secretary; capital stock, $150,000. It is stated that the company will erect a new building, and put in $15,000 worth of machinery.

South Superior, Minn., has secured three new manufacturing plants. They are: Racine Malleable Iron Works, of Racine, Wis.; Pittston Stove Works, of Pittston, Pa., and the Elms Buggy and Carriage Works, of Jackson, Mich. The construction of buildings for these concerns will commence as soon as the weather is mild enough in the spring.

The Pennsylvania Steel Company, Steelton, Pa., will, it is stated, nearly double the capacity of the frog, switch and signal department in the near future. The company has recently started a bridge and structural department, which has been placed under the managment of Charles E. Billin, who was in charge of similar work at the Pencoyd Iron Works.

The Davis Coupling Equipment Company has been incorporated in New York, with a capital stock of $100,000 to manufacture automatic car couplers and attachments, at Cortland, Westchester County, N. Y. The following are the trustees: A. H. S. Davis, Almon C. Brown, James W. Husted, Elizur Z. Foote, Thomas D. Husted, John W. Stokes and James E. Vail.

The Michigan Railway Supply Company, of Detroit, Mich., is building a new factory, 300 feet long by 75 feet wide, at the junction of the Detroit, Grand Haven & Milwaukee and the Bay City division of the Michigan Central. The structure is under roof, and will be completed by May 1. It will give facilities for turning out 2,000 brake beams per day, and also for the manufacture of the company's metallic grain door.

Business is brisk in the crane shop of the Yale & Towne Mfg. Co., at Stamford, Conn. Among recent shipments may be mentioned the following: One 5-ton locomotive crane to the National Tube Works Company, McKeesport, Pa. One 5 ton jib foundry crane to the Corning Iron Works, Corning, N. Y. One 5-ton hand traveler to Guild & Garrison, Brooklyn, N. Y. One 2-ton locomotive crane to the Illinois Central R. R.

The Lodge & Davis Machine Tool Co., of Cincinnati, inform us that, owing to the demand for their tools in the iron districts of western Pennsylvania and eastern Ohio, they have decided to open a machinery store at Pittsburgh, which it is expected will be in operation about the 1st to the 10th of April, and will be under the charge of the secretary of the company, Mr. Augustus Muller. A complete and full line of their well-known machine tools will be kept in stock here for the convenience of customers in that part of the country.

The Michigan Railway Supply Company (Detroit) is building a new factory at the junction of the Detroit, Grand Haven & Milwaukee and the Bay City Division of the Michigan Central. The structure is now under roof, and it is proposed to finish the work by May 1. It is of brick, 300 feet long by 75 feet wide. The company owns six acres of ground on which the factory is located. With the completion of the building the company will have facilities for turning out 2,000 brake beams per day, and also for the manufacture of its metallic grain door.

The John O'Brien Boiler Company, of St. Louis, Mo., will fit out its new boiler works, in that city, with an entire new lot of machinery, including new flanging machines and hydraulic riveters. It is the intention to have all the new machinery ready to start in, so that no time whatever will be lost in moving. The building will be constructed entirely of iron, the dimensions being 350x400 feet, and it will be one of the most complete establishments of its kind in the West. The company expects to go into the manufacture of the down-draught smokeless boiler on a larger scale than before.

J. H. Sternburgh & Son, of Reading, Pa., are recovering from the recent fire by which their main works, machine shop, engine house, tool-room and office were destroyed, together with part of their warehouse. They are also laying foundations for a new machine shop, which will be about twice as large as the old one, and will give a floor space of about 10,000 square feet, and will erect as promptly as possible an iron structure, 360 feet long by 160 feet wide, to be used as their main works, comprising the forging and finishing departments. Plans are now being prepared for this structure.

Francis Pinton, manager of the Milwaukee interests of the Illinois Steel Co., announces that the company will build an extensive plant at Bay View, for the manufacture of cast-iron pipe of every description. The new plant will cost $500,000, and will give employment to 500 men. It will cover about three acres, and will be located about a quarter of a mile north of the rolling-mills. The buildings are to be of stone, brick and iron, and the material for pipe casting will be conveyed direct from the company's blast furnace. This will be by means of an elevated railway from the blast furnace to the new mills, the molten metal being conveyed in small iron cars. Between 400 and 500 tons of pipe will be turned out daily.

Francis Hinton, manager of the Milwaukee interests of the Illinois Steel Company, announces that the company will build an extensive plant at Bay View, Wis., for the manufacture of cast-iron pipe of every description. The new plant will cost $500,000, and will give employment to 500 men. It will cover about three acres, and will be located about a quarter of a mile north of the rolling mills. The buildings are to be of stone, brick and iron, and the material for pipe casting will be conveyed direct from the company's blast furnace. This will be by means of an elevated railway from the blast furnace to the new mills, the molten metal being conveyed in small iron cars. Between 400 and 500 tons of pipe will be turned out daily.

Messrs. John Maslin & Son, proprietors of the Maslin Pump and Machine Works, Nos. 165 and 167 First street, have under consideration a very liberal offer from a Denver (Col.) syndicate for the entire purchase of their plant, including machinery, patterns, etc., and the patents on the Maslin patent automatic steam vacuum pumps. It is the intention of the company to enlarge the Jersey City works, establish a New York office, and also to establish a large works at Greeley, Col. These pumps are extensively used in the South and West for mining and irrigating purposes, and are being introduced and adopted by the government. Several large pumps were shipped to a large mine at Deadwood, South Arizona, last week.

The Brown & Sharpe Mfg. Co., Providence, R. I., are building a new four-story brick building, 100 feet long and 56 feet wide. The construction is similar to that of the main machine shop buildings, and is practically fire-proof throughout. The walls are 20 inches thick and have two ventilating flues 6x8 inches in each pier. A large proportion of the wall space is occupied by windows. The floors and roofs rest on iron beams, supported by three transverse rows of iron columns 16 feet apart. The heavier beams are in pairs and are 20 inches deep; the lighter are 15 inches deep. The latter are 8 feet from center to center and support brick arches 4 inches thick, 10 inches rise. The floors are 5 inches thick. The first layer from beam to beam is 2¾-inch splined spruce plank. The second layer is 1⅛-inch spruce laid diagonally with the plank, and the third, or top layer, is 1⅛-inch hard pine laid parallel with the 3-inch plank. The roof is solid concrete covered with tar and gravel. The stairways are iron. Benches of the Brown & Sharpe standard pattern and their sanitary closets will be used. The building will be devoted to the manufacture of a variety of small tools and instruments for accurate measurements.

The Royal Sovereign and Royal Arthur.

Two warships, the Royal Sovereign and the Royal Arthur, were floated at Portsmouth upon the 26th ultimo. They are two of the seventy additional vessels which were provided for by the Naval Defence act of 1889, the whole of which are to be completed before the end of the financial year 1893-94. The following, taken from *Engineering*, are some of the principal dimensions and particulars of the Royal Sovereign:

Length, 380 feet.
Breadth, 75 feet.
Draught (mean), 27 feet 6 inches.
Displacement, 14 150 tons.
I. H. P., natural draught, 9,000.
I. H. P., forced draught, 13,000.
Speed, natural draught, 16 knots.
Speed, forced draught, 17.5 knots.
Coals carried at the designed load draught. 900 tons.
Coal endurance at 10 knots, 5,000 knots.
Weight of projectile (heaviest), 1,250 pounds.
Weight of charge, 630 pounds.
Total weight of armament, 4,100 tons.
Weight of auxiliary armament, 500 tons.
Greatest thickness side armor, 18 inches.
Greatest thickness protective deck, 3 inches.
Total weight of armor and backing, including protective deck, 4,550 tons.
Total weight of all machinery, spare gear, water in boilers, etc., 1,110 tons.

The Royal Sovereign was commenced on October 1, 1889, not quite seventeen months before she was floated, and during this time 7,200 tons of the total weight of hull of 9,640 tons has been worked in. This shows a remarkable rapidity of building.

The engines are not yet completed, and some of the dimensions of the details may be changed, but the variation from the particulars given will probably be small.

There will be two sets of engines, one for each propeller. The engines will be of the vertical triple-expansion type; cylinders, 40, 59 and 88 inches diameter; stroke, 4 feet 3

inches; boiler pressure, 150 pounds per square inch. The maximum number of revolutions at full power and load draught will be 108. The cylinders are all to be jacketed, the boiler pressure being in the high-pressure jackets, and 100 pounds and 50 pounds in the intermediate and low-pressure jackets respectively. The space between the barrels and the jackets is 1 inch. The high-pressure cylinder liner is of forged steel, the intermediate and low-pressure being cast-iron. They are attached to the cylinder castings by flanges having an expansion joint at one end. The cylinder covers are of steel, and the slide faces are made of separate castings of close-grained iron, the steam ports being stayed with steel screw stays. The pistons are of steel, and are fitted with wide single packing rings, those of the high pressure being of phosphor bronze, while in the low and intermediate pressure they are of cast-iron. They are pressed out by tempered steel springs, and the junk rings are of steel. The piston rods are of solid wrought-steel, with adjustable guides. The connecting rods are of wrought-steel, the length between centers being 8 feet 4 inches. The bearings are lined with white metal at the crank ends. The shafting is hollow. The crankshafts are of steel. The diameter of the bearings is not to be less than 15¾ inches at any part, the aggregate length of bearings in each set of engines is to be about 9 feet. The diameter of the crank pins is to be not less than 16¼ inches, and their length about 18 inches. The crank-shaft brasses are to be lined with white metal. The diameter of the shafting between crank-shafts and stern tube shafts is not to be less than 14¾ inches outside, that of the stern-shafts in the stern tubes not less than 15¾ inches outside, exclusive of the casing, and 16 inches in diameter outside of the ship. The hole in the hollow shafting is about 8 inches in diameter. The thrust block has in all 1,500 square inches of surface on the collars for each set of engines. The tubes through the stern, as well as the bushes through the outer brackets, are of gun metal, and are not less than 1¼ inch thick at bearings, and the shafts within are cased with gun-metal to prevent access of water to the shafts, the casings being not less than 1½ inch in thickness at the bearings. Each stern tube is in one length. The propellers are 17½ feet in diameter, and work outward. The blades are attached to the boss so that the pitch may be varied as required. The main condensers are of brass, no iron being used for small internal fittings. There will be an auxiliary condenser in each engine-room, fitted with separate circulating pumping engines and air-pumps for the auxiliary engines throughout the ship. The combined area of cooling surface of the two main condensers will be about 14,000 square feet, and of the two auxiliary condensers not less than 1,800 square feet. The condenser tubes throughout will be of solid drawn brass untinned, and having not less than 70 per cent. of copper and 1 per cent. of tin, the remaining material to be zinc. The tube plates will be Muntz metal. Cotton packing and screwed glands will be used. There will be two separate circulating pumping engines in each engine-room, each large enough for full power working. At 300 revolutions per minute, and 100 pounds of steam, without vacuum, each main circulating pump must be capable of discharging 1,100 tons of water from the bilge per hour. The boilers are to be eight in number, and will contain 32 furnaces. The total area of tube surface will be not less than 17,000 square feet, and the fire grate area will be 700 square feet. The whole material, including tubes, will be steel. Tubes 2¼ inches diameter, and not less than 0.165-inch thick. They will be spaced not less than 1 inch apart.

The Royal Arthur is one of nine first-class twin-screw protected cruisers provided for by the Naval Defence act of 1889. The following are its chief features as designed:

Length, 360 feet.

Breadth, 60 feet.

Mean load draught, 23 feet 9 inches.

Displacement, 7,350 tons.

Weight of hull and fittings, 4,040 tons.

Indicated horse-power, forced draught, 12,000.

Indicated horse-power, natural draught, 7,500.

Maximum speed on measured mile, fully laden (forced draught), 20 knots.

Maximum speed on measured mile, fully laden (natural draught), 18 knots.

Coal stowage at load draught, 850 tons.

Radius of action at 10 knots speed, 10,000 knots.

Maximum thickness of steel protective deck, 5 inches.

The engines, in two sets, will be of the ordinary inverted direct-acting triple-expansion type. The diameters of cylinders will be 40, 59 and 88 inches, and length of stroke 51 inches. The connecting rods will be 8 feet between centers. The shafting is to be of hollow steel; crank-shaft journals, 15¾ inches in diameter. The aggregate length of the bearings in each set of engines will be about 9 feet. The diameter of crank-pins will be 16¼ inches, with a hole 8½ inches through them, the length being 18 inches. The shafting between the engines and the stern tube will not be less than 14¾ inches diameter; the outside lengths, 16 inches diameter. The thrust surface will be about 1,300 square inches for each set of engines. The piston rods will be 8 inches diameter; the connecting rods, 7⅞ inches diameter in the middle, and 6⅞ inches at the ends. The main condensers will be of brass, the condensing water passing through horizontal tubes. The total cooling surface will be about 13,500 square feet. There will be 6,900 tubes, ¾ inch diameter, 10 feet long, and pitched 1⅛ inches. There will be an auxiliary condenser in each engine-room for the use of auxiliary engines throughout the ship. They will be fitted complete with separate circulating pumping engines and air-pumps. These auxiliary condensers will have a total cooling surface of 1,600 square feet, and will contain 1,760 tubes, ¾ inch diameter and 4 feet 8 inches long. There will be one upright single-acting air-pump to each main engine, worked by levers from the high-pressure cylinder crossheads. They will be 33 inches diameter and 22 inches stroke. The auxiliary air-pumps will be 9 inches diameter and 7 inches stroke.

There will be eight cylindrical single-ended boilers, each 16 feet 3 inches diameter, and 9 feet 10 inches long, capable of working to 155 pounds to the square inch; 32 corrugated furnaces, with an average diameter of 43 inches, and 7 feet 6 inches long. The total fire-grate area will be 855 square feet. The tubes will be of steel, the total number being nearly 5,000. They will be 2½ inches diameter, and 6 feet 11½ inches long, the weight being 4 pounds per foot run, the stay tubes 6 pounds per foot run. The total area of tube surface will be 21,400 square feet.

The Royal Arthur was commenced in January of last year, and has been just about thirteen months in course of construction.

N. A. S. E., No. 1, of New Jersey.

At an open meeting of No. 1, N. A. S. E., of New Jersey, held on the evening of the 14th, President Cronley, in introducing the speaker for the evening, made some statements in regard to national and subordinate associations. He said, in part, as follows:

The National Association of Stationary Engineers has a membership of more than 6,000, divided between 153 subordinate associations, representing every State and large city in the Union. A candidate to join the association must be of good moral character, and understand the precautionary laws governing a plant; must be between the age of 21 and 45, and have run an engine for at least one year.

* * * * * * *

The dangers surrounding the operation and management of a steam plant are greater than those connected with any other machinery employed in the generation and transmission of power; therefore, to reduce the accidents to a minimum, the National Association of Stationary Engineers was organized; this is the great aim of our association. To accomplish this desirable result our best efforts are—and must continue to be—directed toward the education and enlightenment of the steam engineers of America in the art and science of steam engineering, and the procuring of enactments of the most stringent and efficient license laws by every State in the Union; laws prohibiting the employment of incompetent, careless, reckless or intemperate men in the care or management of steam plants.

Every State in the Union prohibits by statutory enactments of the strictest kind the practice of medicine by incompetent persons. * * * * * * Every State in the Union, as well as the federal government, has provided for the better protection of property—human rights, human liberty, as well as human life—by prohibiting the practice of law by those except such as have passed a thorough and rigid examination before a legally constituted board of examiners, and received a diploma or license as evidence of their qualification to practice law.

Reasoning from the propriety of laws preventing incompetent persons from practicing medicine or law, President Cronley went on to argue the greater propriety of protecting the community against the practice of steam engine and boiler management by those who were constantly endangering life and property.

The National Association of Stationary Engineers had established a great school of steam engineering, and through its instrumentality proposed to educate its members, and to elevate them in the social, moral and intellectual scale, and to secure for them proper recognition.

How to Treat "Live" Wires.

The following advice from an experienced electrician with regard to "live" wires is worth remembering: "Never touch an electric wire that has fallen down across your way while you are standing on the ground, as your body will become a conductor for the electric fluid to the earth, unless you have rubber boots upon your feet. Linemen are sometimes seen pulling these wires about, but they have insulating rubber boots upon their feet, or gloves of like material upon their hands, and some people, supposing these coverings to be only used for protection against the wet weather, have foolishly grasped the wires and received severe shocks in consequence. Don't employ a carpenter or ordinary laborer, nor do you yourself attempt to fix any electric apparatus of any power about your property, whether the current is turned on or not. Electric wires should be handled one at a time. If it is necessary to take hold of two wires at the same time, don't do it. In handling or drawing any wire lying over any of the ordinary street wires, especially such as convey currents for electric lighting, use a dry hand line for the purpose, or grasp the wire with insulated pincers. An ordinary wire clothes line may become the conductor of a deadly current. In a dynamo-room, touch not, taste not, handle not. The most inoffensive-looking dish-pan may strike you like a mailed hand. Nothing is safe to you here, unless you know everything. Let workingmen remember that when a company has strung wires on the crossbars of poles so closely together that a man cannot move easily between them, it is better for him to come down and resign. What profiteth it a man that he has a situation if his wife be a widow? Never close a circuit without giving notice to all concerned. A telegraph notice received in the back of the neck generally arrives too late to do any good. On no condition let two wires touch your body at the same time. Don't think that any wire is not dangerous. There is a difference between a gun with a cap on it and one without that can be detected with the naked eye; but a loaded wire—who knoweth it? Trimmers employed to attend to lights in crowded public thoroughfares should be sure that the current is turned off before they touch the lamp, as the step-ladders are often very high, and the public objects to being hit on the head by a gyrating, galvanized lamp trimmer."

A friend sends us samples of twine made from marsh grass for use in grain binders, the machine which makes the twine being the invention of Mr. George A. Lowry, of Hoosic Falls, N. Y. The twine appears to be all that could be desired in this line, and as the material from which it is made is very abundant, and the machine converts it into twine at small cost comparatively, we do not see why it should not become an important factor in carrying on harvesting operations. It is said that the same machine is capable of making small cord, from which a coarse cloth can be made suitable for covering cotton bales, and that this cloth can be produced considerably cheaper than jute bagging.

The Middletown Machine Company, of Middletown, Ohio, write to say that they consider the collar for shafting, etc., illustrated on page 7 of our issue of March 12, an infringement of their patent on a collar which was illustrated by us Dec. 27, 1888.

By an error we were made to say in our issue of March 5, that "Jenkins & Lingle, of Bellefonte, *Ohio*, were selling the Jenkins improved hammers," etc. Bellefonte is in Pennsylvania.

Machinists' Supplies and Iron.

NEW YORK, March 21, 1891.

Iron—American Pig—The market is not quite so strong as last week, and there are rumors of somewhat lower prices having been accepted for certain brands, but prices are not quotably lower, and as stock on hand is reported to be light, sellers do not expect lower prices.

We quote No. 1 Foundry, Standard Northern brands, $17 to $18; No. 2, $15.75 to $17; Gray Forge, $14.25 to $15; Southern brands No. 1 Foundry, $16 to $17.50; No. 2, $15.25 to $16; No. 3, $14 to $14.50.

Scotch Pig—The market continues dull.

We quote Coltness, $24.50; Dalmellington, $22 to $23, and Eglinton, $20.50.

Copper—There are many conflicting reports regarding the condition of the market, and it is in a very unsettled state. Plenty of Lake can be had at 14c., and it is said that transactions have taken place at 13¾c. to 13¾c. Casting copper at retail is 11¾c. to 12c.; Arizona Ingot 12¼c. to 13c.

Lead—The market is quiet, prices for car-load lots being 4.35c. to 4.75c.

Spelter—Though the demand continues light, a firmer feeling seems to pervade the market, and values for Western range at 5.05c. to 5.10c.

Tin—There is some indication of increased demand, and the market is firmer, though little actual trading has been done. Values range 20.10c. to 20.25c. for spot delivery.

Lard Oil—There has been an advance to 52c. to 52½c. for Prime.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Agents for fine surface gauges; big profits. Address E. G. Smith, Columbia, Pa.

Position wanted as practical draftsman. Address K., AMERICAN MACHINIST.

Exp'd mechanical draftsman, with tech. education and refs., wants position. Box 69, AM. MACH.

An experienced mechanical draftsman wants a position. C. V. H., AMERICAN MACHINIST.

Wanted—Position by a first-class machinist; had experience as foreman. Address Jewett, AM. MACH.

Wanted—Position having charge of men, or as draftsman. References. Practical, AM. MACH.

Wanted—Agents for the Blake damper regulator. See advertisement, page 13.

Wanted—A few first-class machinists for engine work on tools and erecting floor. The Ball Engine Company, Erie, Pa.

Wanted—Position as draftsman; thorough exp. with Corliss engines, boilers and machine design; capable of taking charge. Reliable, AM. MACHINIST.

Wanted—Situation by a first-class molder, capable of taking charge of shop; good references. Address Box 70, AMERICAN MACHINIST.

Core maker, thoroughly competent, sand or loam, wishes engagement; able to work men or boys to best advantage. Address Box 68, AM. MACH.

Wanted—By a young man, a practical machinist, also draftsman wants a position as draftsman. Address F. B., Drifton, Luzerne Co., Pennsylvania.

First-class mechanical draftsman and machinist (graduate Norway), 16 years experience (9 years in U. S.) wants position as draftsman or assistant engineer. A 1 refs. H. 32, AMERICAN MACHINIST.

Wanted—A first-class universal milling machine hand to run a Brown & Sharpe machine. Also two first-class tool makers. Address National Cash Register Co., Dayton, Ohio.

Wanted—Foreman for iron foundry running 60 molders on pipe fittings and valves. Address, giving references, and salary required. Box 50, AM. MACHINIST.

Wanted—A draftsman capable of designing special tools and fixtures for making the parts of cotton machinery economically and accurately. Give age, exp. and wages expected. B., AM. MACH.

Wanted—Foreman for machine shop on engine work; good wages will be paid an experienced man. Address, giving references, J. H. McEwen & Co., Ridgway, Pa.

Wanted at once, first-class machinists and machine erectors, for outside work; men familiar with rolling-mill and blast furnace work preferred. Address G. P. Raidabaugh, Sparrow's Point, Md.

Wanted—First-class boiler maker to take half interest in shop in small town. Substantial and growing business guaranteed. Wm. Bartley & Sons, Bartley, N. J.

An educated designer, experienced in shop steel works, tool and engine design, and shop management, desires an engagement. A 1 references. Address New York, care of AMERICAN MACHINIST.

Wanted—Foreman for foundry located in a large western city; one who is familiar with fine machine and car wheel work preferred. Address D. F., care AMERICAN MACHINIST, giving reference, and salary expected.

A first-class mechanical draftsman, young, with good experience both over the board and on outside work, superior designing ability, and good general business qualifications, wants position where ability and industry will insure advancement. References. Mech. Eng., P. O. Box 2538, N. Y. City.

Salesman Wanted—An active, reliable man, to sell supply specialties such as wood pulleys, shafting, leather belting, etc., in New York and vicinity. Address, with references, Pulleys, Box 3459, New York Post Office.

Wanted—Foremanship of a boiler shop in manufacturing concern by a practical and competent man; twenty years exp., best of references; can bring a good assistant foreman. Address G. B. T., 78 Chester Av., Chelsea, Mass.

Wanted—Foreman for shop constructing light machinery and contract work; must be able to estimate on work from drawings and samples; take entire charge of factory; a worker wanted who can push and control men. Competent, Am. Machinist.

Wanted—A man who thoroughly understands repair work on small intricate and fine machinery; must be sober and well recommended; steady employment can be given such a man. Address, stating wages wanted, The Ames-Bonner Co., Toledo, O.

Experienced mechanical draftsman and machinist, well up in the manufacture and use of rubber-mill machinery, desires position with a rubber firm or one manufacturing above machinery. A rare opportunity for parties wishing to start into this business. Best of references. Address A 1, Am. Machinist.

A pushing, practical mechanic and fair draftsman (31) wants a position as foreman of machine shop, or charge of engines, boilers and machinery; has held such positions; can give best of reference; had large experience in mill work and repair work, besides building engines, furnace, saw-mill and wire nail machines. Address J. H. B., Box 432, Greenville, Mercer County, Pa.

To Superintendents and Others—Two gentlemen in the vicinity of New York City would like to engage in the manufacture of some article of ready sale, and in which there is a good profit. For this purpose they would like to meet with a practical man who has the knowledge and ability to establish and superintend such an enterprise. To a suitable person a certain interest would be given. State full particulars as to nature of business. References required. Address X. P. Q., Am. Mach.

Wanted—A first-class mechanic having $5,000 to engage with an established concern in the manufacture of machine tools in the best machine tool center in the West. Have orders for three months ahead, and can secure order at once for $30,000 in addition. Only first-class man with executive ability, having had experience in manufacturing high grade machine tools, need apply. Address Business, American Machinist.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 25 cents per line, each insertion.

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Just out: aluminum steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Wanted—Some reliable firm to manufacture, on royalty, my patent tubular sled, or will sell; send for circular. John I. Hancock, Montrose, Pa.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

A widely known house of unquestioned responsibility, and exceptional facilities for introducing new articles in all parts of the United States, would accept agency for a first-class mechanical device adapted to popular use. Address, with full particulars, P. O. Box 3286, New York.

"TIME IS MONEY."

"The smith his iron measures
Hammered to the anvil's chime."—Longfellow.

"And his **BRADLEY HAMMER** treasures,
Since it saves him work and time."—Some-other-fellow.

2000 IN USE. **PLEASE INVESTIGATE.**

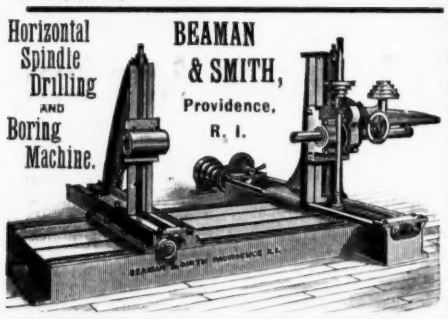
BRADLEY & CO., SYRACUSE, N. Y.

14 Warren St., New York. 96 & 98 Sudbury St., Boston.

INCOMBUSTIBLE MACHINERY

Wiping Material, much cheaper and better than Cotton Waste. Consumers and dealers should write for particulars to Borden & Remington, Fall River, Mass., U. S. A.

Horizontal Spindle Drilling AND Boring Machine.



BEAMAN & SMITH, Providence, R. I.

BELTS AND PULLEYS.

Explanation of Fundamental Principles, of Strength and Proportions of Pulleys and Drums, Rules for Rope Gearing, etc.

BY

J. HOWARD CROMWALL,

12mo, Cloth, $1.50.

JNO. WILEY & SONS, NEW YORK.

BELLOWS Beam Micrometer

Send for Catalogue to

STANDARD TOOL CO., Athol, Mass.

MACHINERY For Reducing and Pointing Wire.

ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.

For Machines or Information, address the Manufacturer,

S. W. GOODYEAR, Waterbury, Ct.

STEEL TUBES

WELDLESS SMOOTH · COLD DRAWN

John S. Leng's Son & Co. New York.

CATALOGUE TOOLS & SUPPLIES FREE

TAPS TO FIT SCREWS MACHINE ALL SIZES 63 SUDBURY ST. BOSTON

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with an established business who are desirous of removing their works to a place within an hour of New York City; with good water front for sites; with water and rail transportation, and most attractive for residence, will find it to their advantage to address

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Stamford, Conn.

ASBESTOS CEMENT FELTING.

FOR LAGGING LOCOMOTIVE BOILERS.

Samples and Descriptive Price List Free by Mail

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

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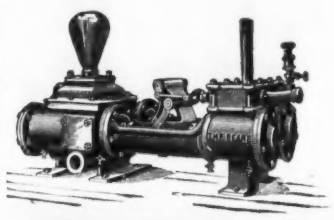

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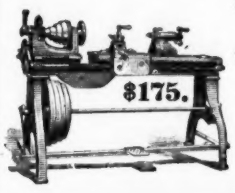

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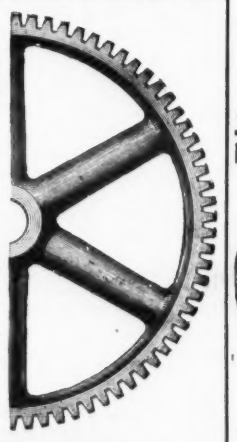

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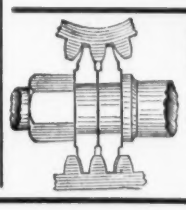

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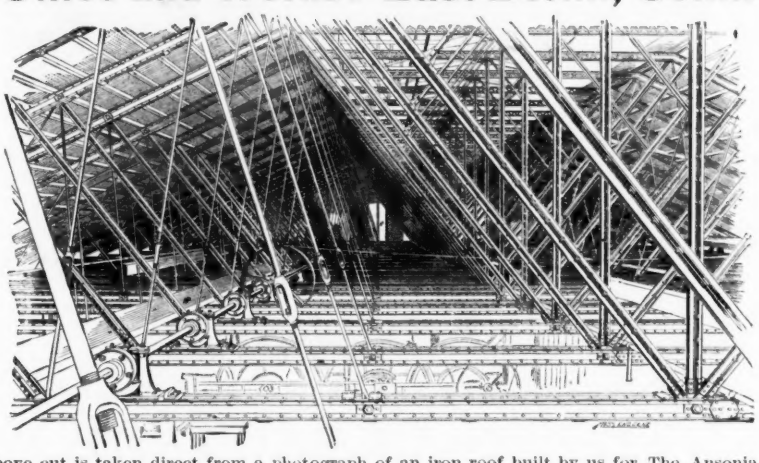

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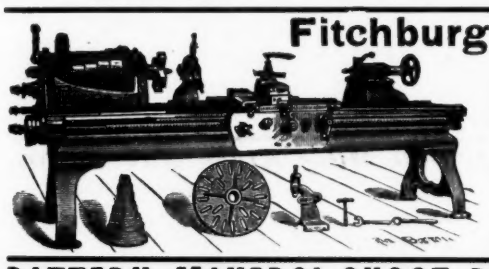

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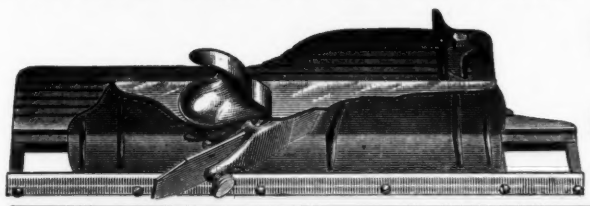

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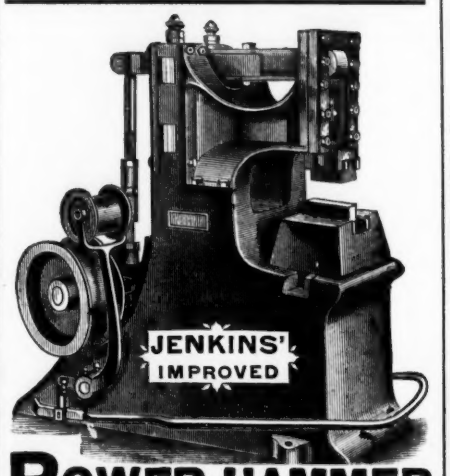

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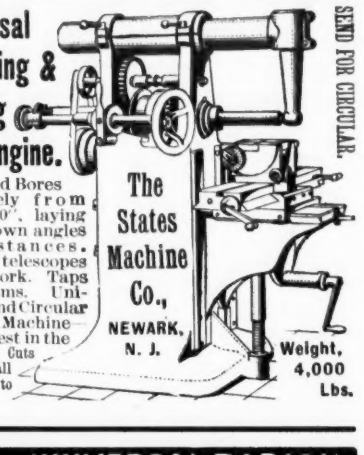

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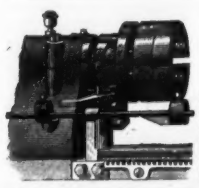
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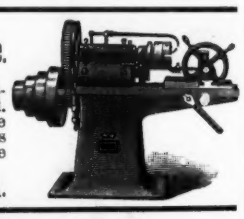

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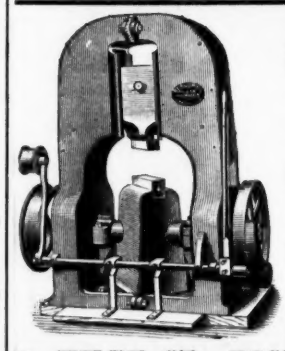
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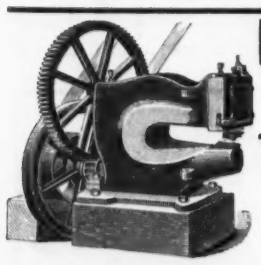
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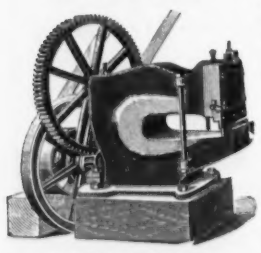
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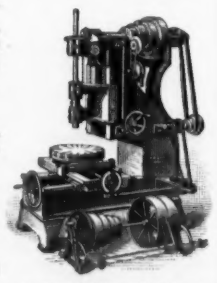
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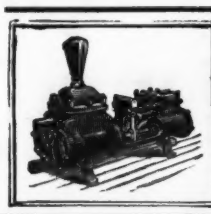
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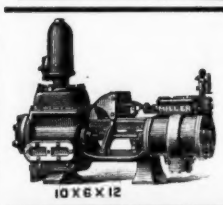
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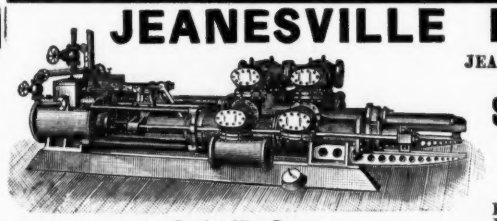
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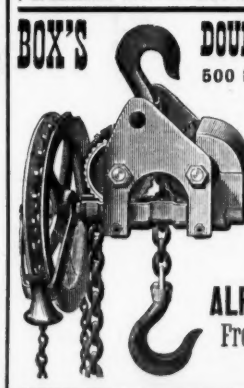
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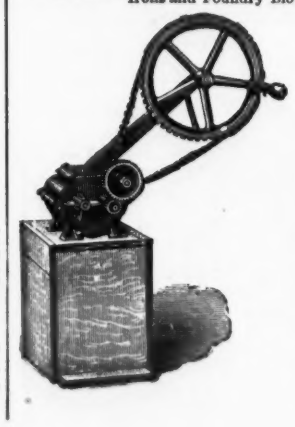
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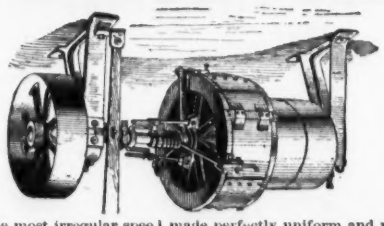
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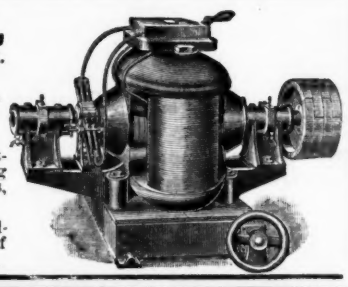

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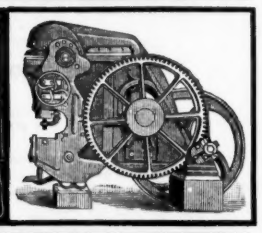

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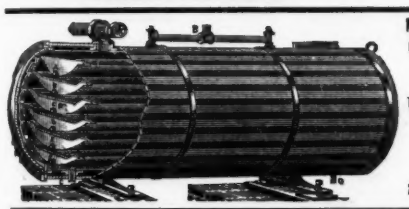

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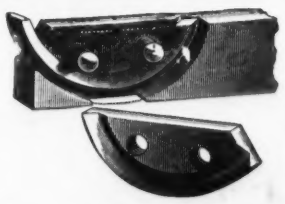

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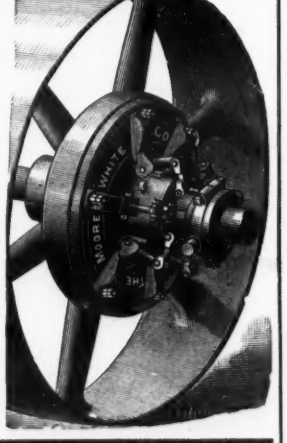

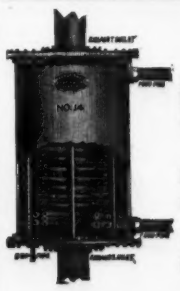

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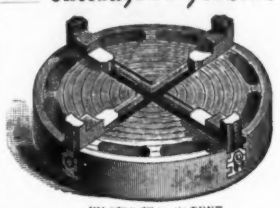
16 in.	18 in.
18 1-2 in.	21 1-2 in.
21 1-4 in.	26 in
24 in.	30 [illegible]
30 in.	36 in.
36 in.	43 in.



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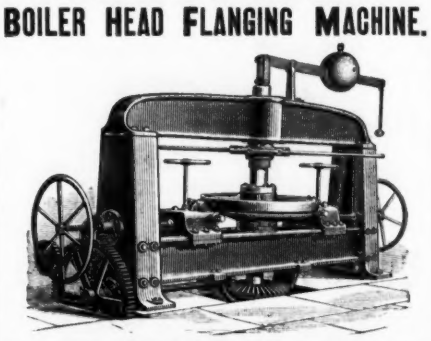

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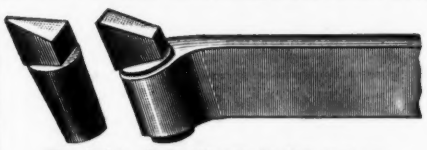

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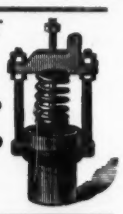

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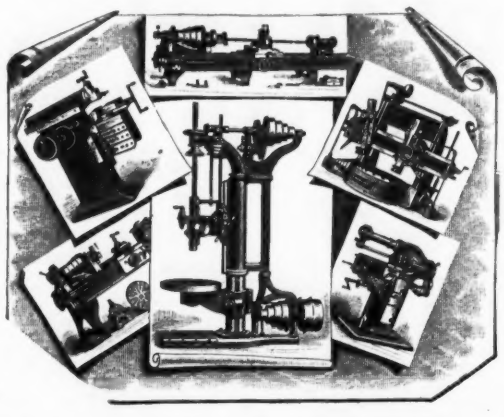

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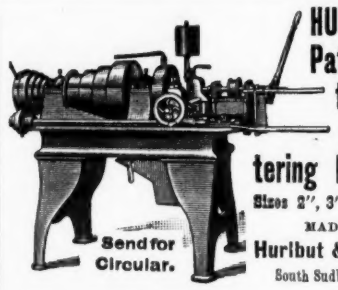

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Sizes 2", 3", 4", 5", 6".
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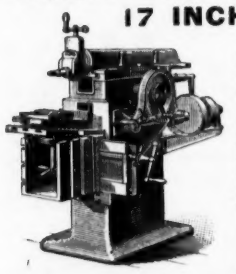

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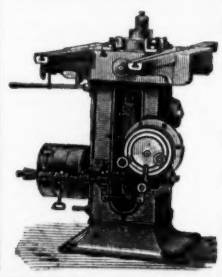

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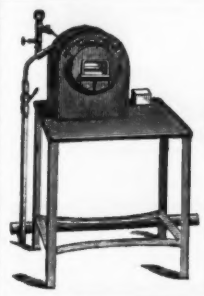

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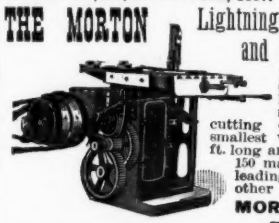

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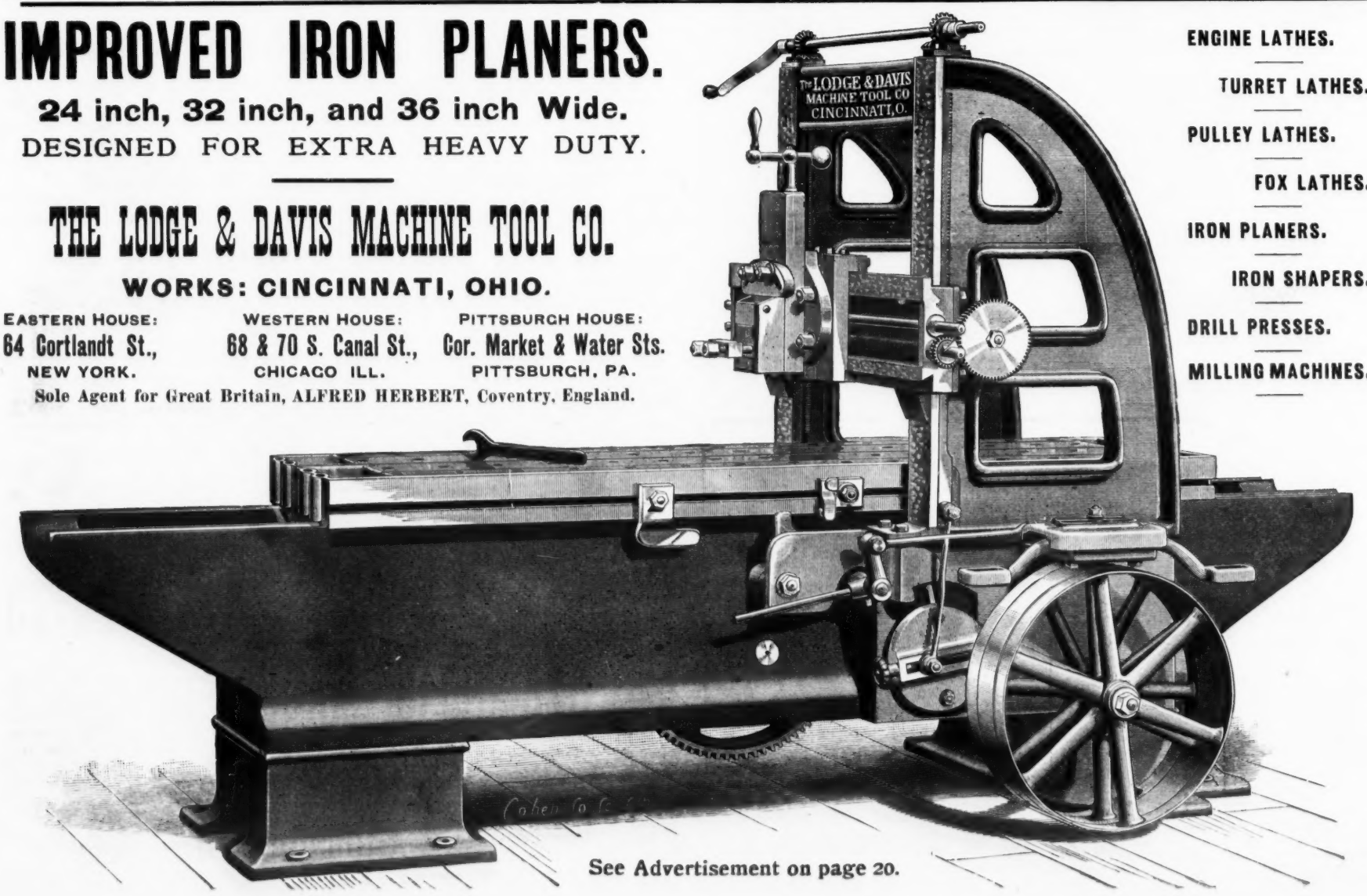

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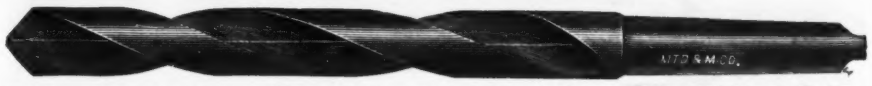

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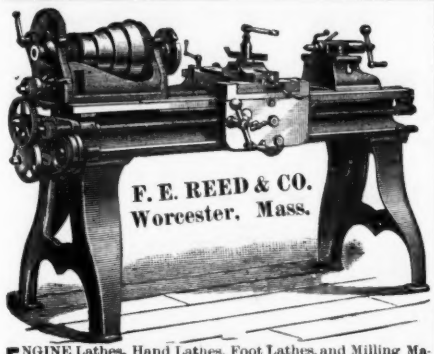

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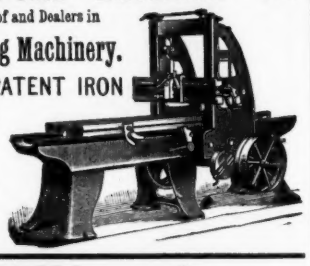

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From 16" to 36" wide by any length.
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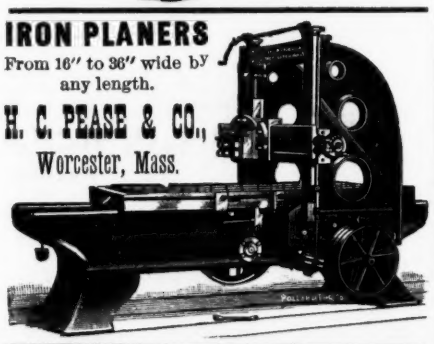

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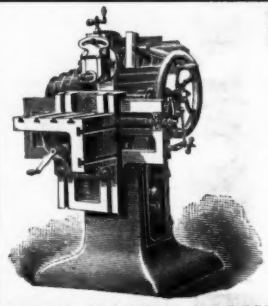

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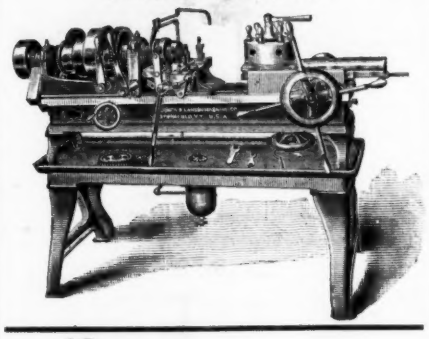

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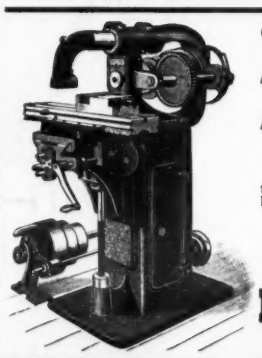

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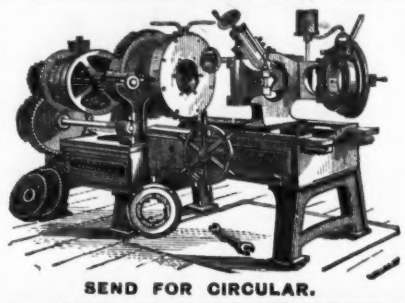

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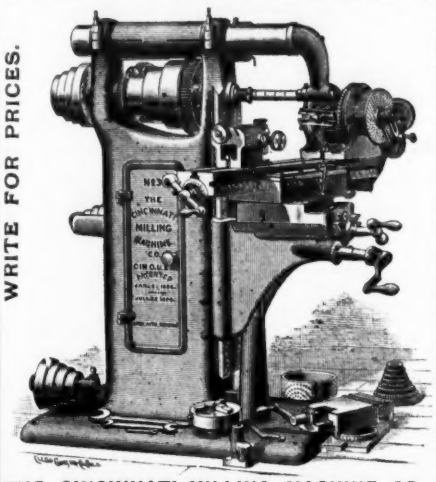

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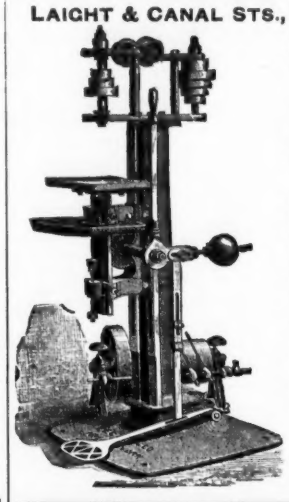

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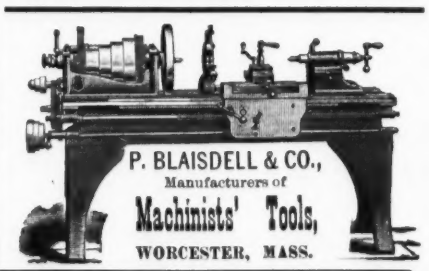

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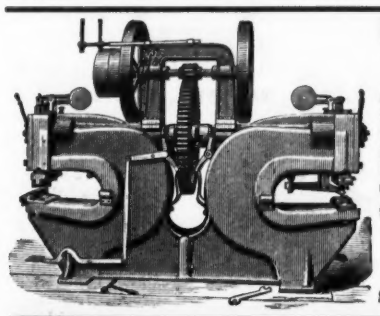

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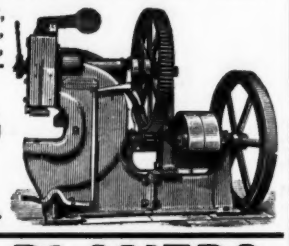

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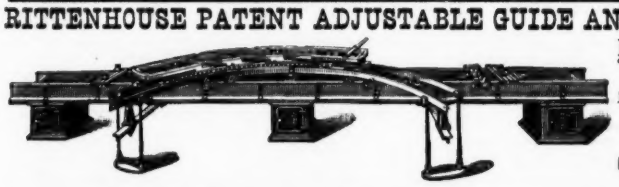

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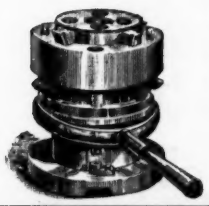

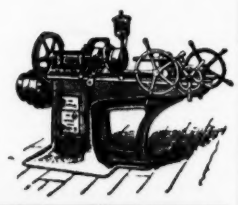

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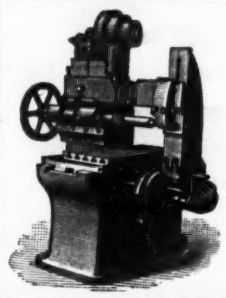

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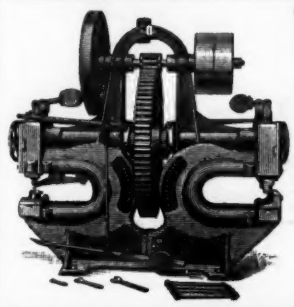

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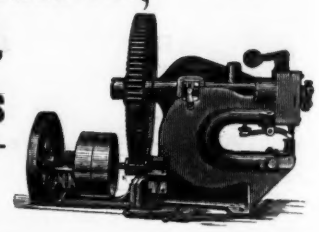

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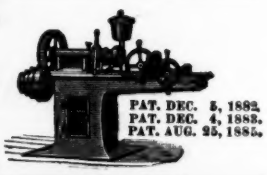

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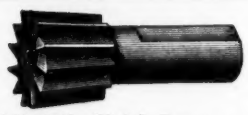

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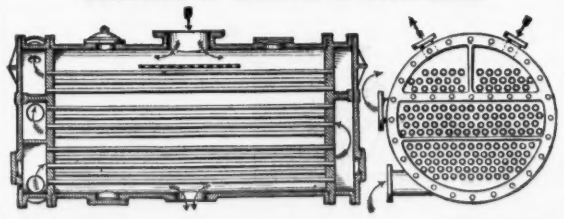

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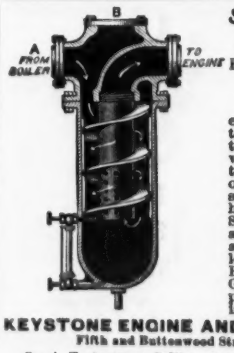

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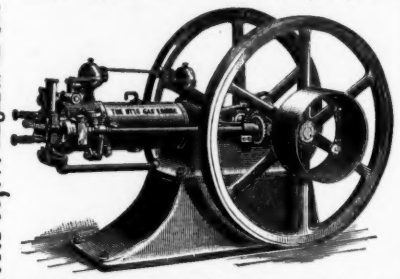

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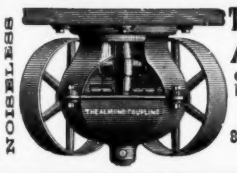

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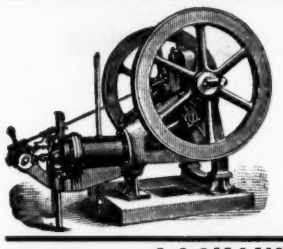

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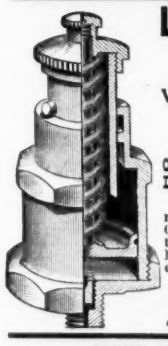

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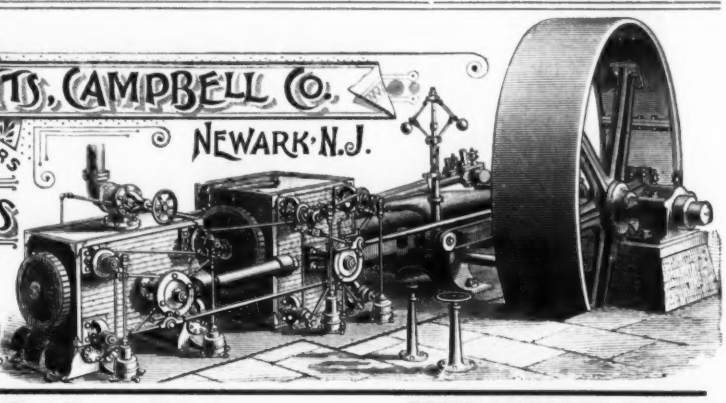

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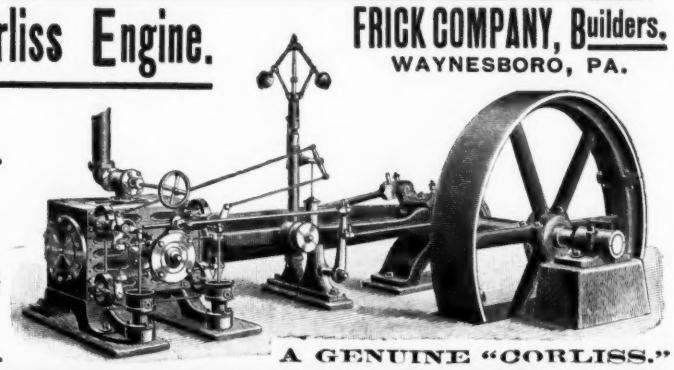

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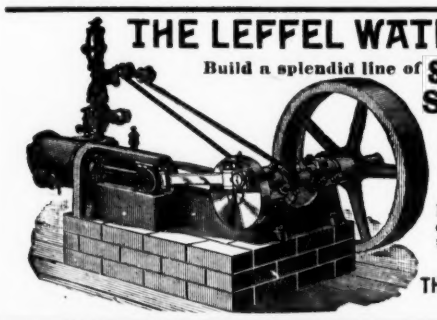

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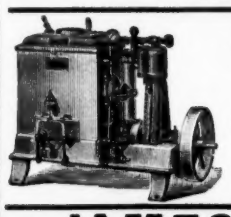

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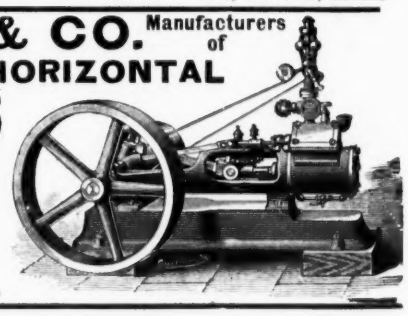

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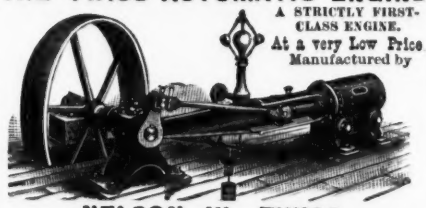

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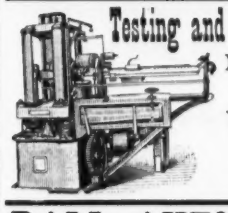

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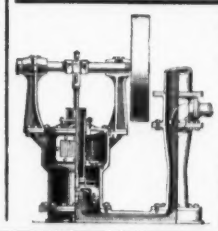

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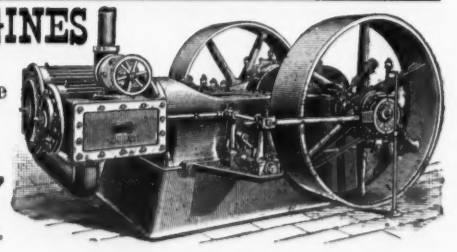

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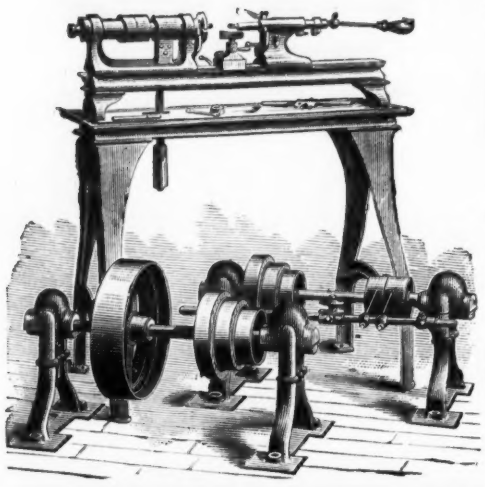

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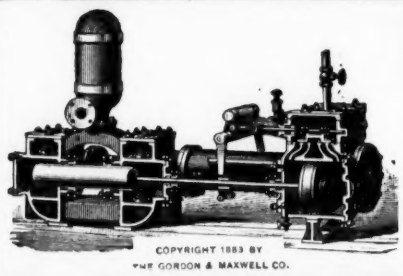

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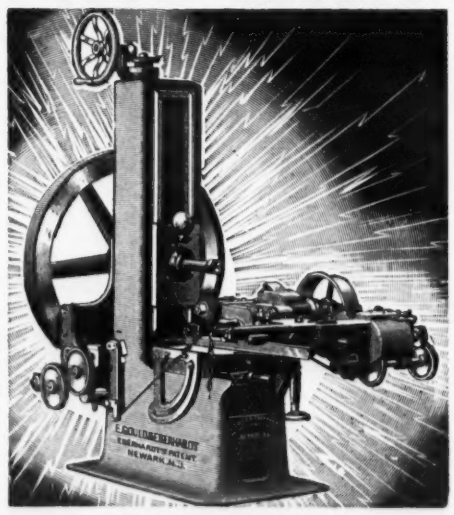

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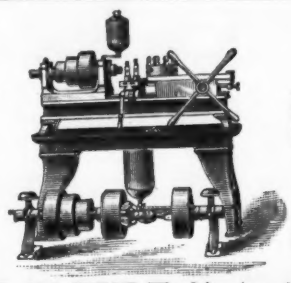

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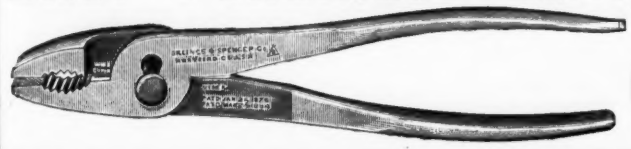

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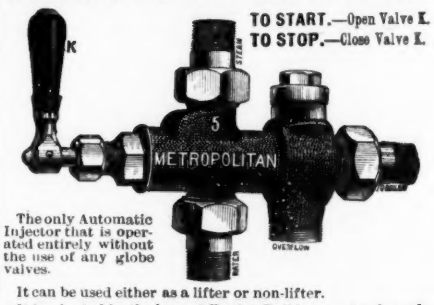

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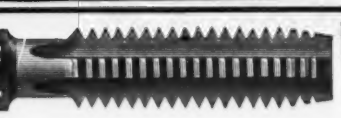

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